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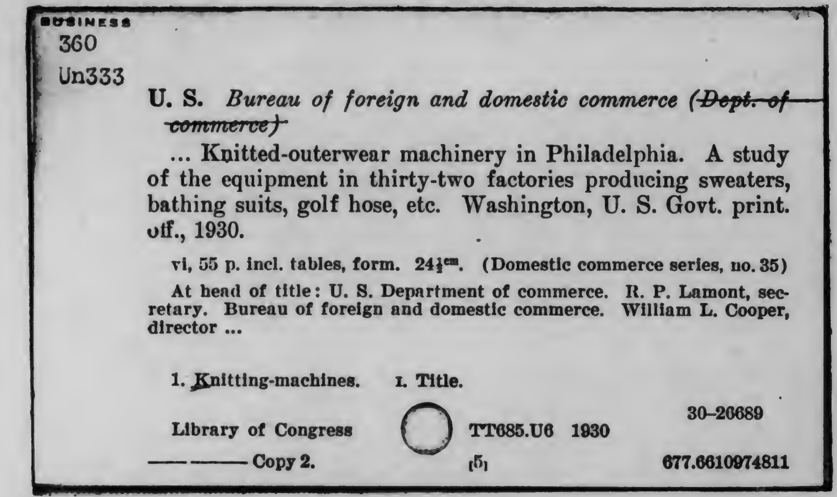

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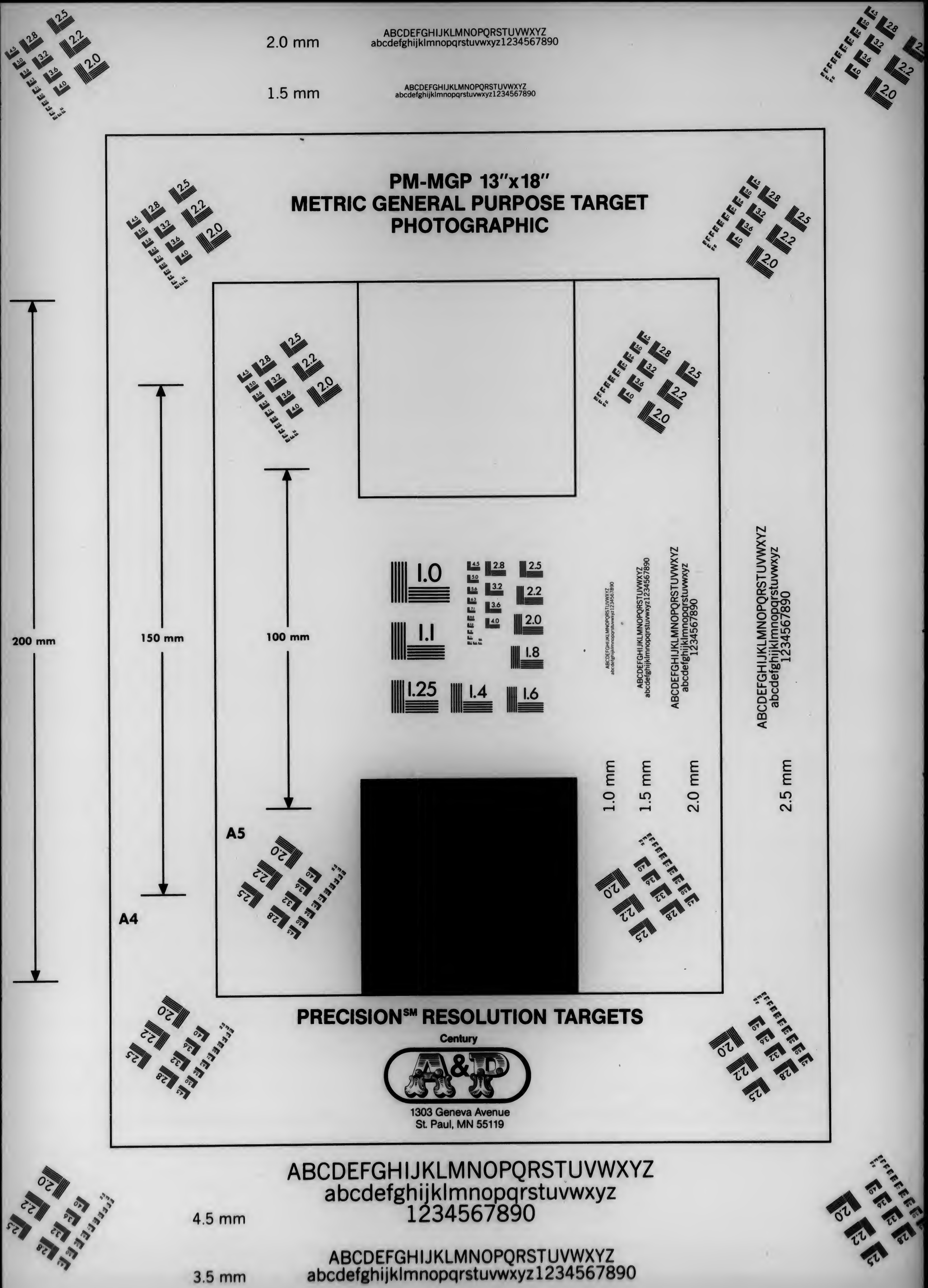

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KNITTED-OUTERWEAR MACHINERY IN PHILADELPHIA

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Domestic Commerce Series—No. 35

KNITTED-OUTERWEAR MACHINERY IN PHILADELPHIA

A STUDY OF THE EQUIPMENT IN THIRTY-TWO FACTORIES PRODUCING SWEATERS BATHING SUITS, GOLF HOSE, ETC.

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FOREWORD

Like many other industries, the group of manufacturers producing sweaters, bathing suits, golf hose, and similar wear have been struggling with problems of so-called profitless prosperity, excess factory capacity, competition that sometimes seems excessive if not unintelligent, and the long category of related problems that receive the attention of the trade associations. Further thought on these subjects raises a question as to the extent to which these evils result from excess factory capacity, which in turn raises a question as to what extent existing capacity is out of date—that is, as to the possibility that obsolete or worn-out machinery is being retained in operation too long.

In the knitted-outerwear industry obsolescence in style of the finished product is undoubtedly a matter of graver concern than in the case of many other industries. In recent years the old type of sweater with its heavy yarn and single color has been giving way to lighter-weight, more ornamental, and more varied garments, with a resulting need for ever-changing types of manufacturing equipment.

The National Knitted Outerwear Association, finding it difficult to cope with these various problems because of the lack of sufficient concrete information, requested the Department of Commerce to make a survey of the equipment used in Philadelphia knitted-outerwear plants. The department made the survey, and the results are presented in this report.

This study is the first of its kind and in many respects is experimental. The material presented herewith should be considered as merely the first effort to solve some rather obscure problems. The indications are that similar studies will be made in other areas, and it may be that additional types of information can be obtained which will lead to more definite conclusions than were possible in this study.

However, even making due allowance for its limitations, the report here presented will probably be found of great interest, not merely because of its significance to the industries immediately concerned, but because it serves as a beginning in establishing certain fundamental business principles that apply more or less directly to all manufacturing industries. The problems of handling depreciation and obsolescence, their relationship to costs of manufacture and to accounting generally, and the policies that should be followed in keeping factory equipment up to date without accumulating undue and excessive capacity do not yet appear to have been adequately solved by industry.

The field work for this study was conducted by William Stewart Ayars, special agent of the Bureau of Foreign and Domestic Commerce, under the direction of Howard C. Dunn, Chief of the Domestic Commerce Division of that bureau. The bureau had the cooperation of Ellery B. Gordon, secretary of the National Knitted Outerwear Association, and a committee representing that association headed by Bernard Steuer. The data were collected by Mr. Ayars through personal visits to the knitted-outerwear plants in Philadelphia and were subsequently submitted to the cooperating committee of the industry, which in turn estimated the degree of obsolescence. This material was analyzed, tabulated, and developed into a report through the collaboration of Walter H. Rastall, Chief of the Industrial Machinery Division, and Constant Southworth, of the Domestic Commerce Division, both of the Bureau of Foreign and Domestic Commerce.

William L. Cooper, *Director,*
Bureau of Foreign and Domestic Commerce.

April, 1930.

KNITTED-OUTERWEAR MACHINERY IN PHILADELPHIA

PURPOSE AND METHOD OF SURVEY

At the request of the National Knitted Outerwear Association, this study was undertaken to obtain information for the purpose of enabling manufacturers of knitted outerwear to develop more scientific policies with regard to the scrapping and replacing of factory machinery, based not only on the comparative ability of various types and models of machines to produce products at present in vogue, but upon the relative costs of producing on various types and models of machines. The problem of ascertaining these costs is somewhat complicated, because it involves attention not only to labor and materials and other obvious items of accounting, but to such matters as depreciation and obsolescence. For instance, in measuring the comparative costs of producing on different types and models of machines, it is necessary to take account of rate of output, efficiency of the manufacturing process involved, floor space, power consumed, and the relation of these various matters to excessive production or even possibly unintelligent competition.

But since the undertaking of this study represents the first approach to the solution of some of these problems, it appeared unwise to attempt a complete solution. Instead, information covering the more obvious points was collected, leaving for subsequent studies many of the more difficult features for which additional time was needed to obtain adequate data.

OUTSTANDING PROBLEMS

The survey brought out some interesting facts and suggested certain directions in which improvement in machinery replacement policy may be attained. Nevertheless, a word of caution should be added, for it is quite possible that subsequent surveys in other districts will demonstrate that the conditions found in the limited area of Philadelphia are not representative of the entire industry and that the conclusions of this study will later require modification.

SUMMARY OF MACHINE MAKES

The various makes of machines represented in the survey are summarized in Table A (each make indicated by a letter), which shows that among the circular machines four makes accounted for 83 per cent of the total knitting equipment, and among the flat machines two makes accounted for 75 per cent of the total.

Thirty-two plants in Philadelphia were visited between December 18, 1928, and April 8, 1929, in an effort to develop a complete inventory of the machinery in those plants. This inventory was found to include 1,153 circular knitting machines and 451 flat knitting machines.

After the data were gathered, they were arranged in such a manner that they would not indicate the identity of the plants owning the machines. Then the cooperating committee, composed of members of the knitted-outerwear industry, with the help of these data furnished percentage ratings which would indicate their opinion as to the extent of obsolescence and depreciation of each machine.

TABLE A.—MAKES OF MACHINES

Circular machines			Flat machines		
Make	Number	Per cent	Make	Number	Per cent
A	3	(1)	A	3	1
B	9	1	B	2	1
C	111	10	C	2	1
D	2	(1)	D	18	5
E	12	1	E	24	7
F	73	6	F	202	56
G	3	(1)	G	1	(1)
H	58	5	H	69	19
I	241	21	I	14	4
J	19	2	J	12	3
K	10	1	K	5	1
L	1	(1)	L	3	1
M	206	18	M	4	1
N	380	34			
Total	1,128	100	Total	359	100
Unknown	25	----------	Unknown	92	----------
Grand total	1,153	----------	Grand total	451	----------

[1] Less than one-half of 1 per cent.
[2] These machines are of separate type (Raschel), rather than make.

IS THERE EXCESSIVE CAPACITY?

An effort was made to discover the degree of inactivity of the equipment studied; and it will be observed from Table B that out of 805 circular machines for which information is available 416 operated 50 per cent of the time, or less, during the second half of 1928, and only 226 machines operated normal full time or longer periods. A somewhat similar situation applied to the flat machines. This table suggests that the knitted-outerwear industry can probably produce two garments for every one sold, a condition which implies, among other things perhaps, that the industry has an excess of factory capacity. The situation creates the possibility of a need for the most efficient sales methods to market the product of all the existing machinery, or some plan of reducing the excess capacity, if any part of it is caused by machines which are obsolete, antiquated, or otherwise unsuited for efficient production. The relation of idleness to the different sizes of machines is shown in Table 11, page 39, and deserves careful study, because possibly there is less tendency to overcapacity in certain sizes than in others. Similarly, other tables in the appendix (see index, p. 25) show the relationship of idleness to other features of the machines, such as style and number of needles per inch. However, one must guard against too definite conclusions as to the tendency of certain sizes or styles of machinery to be more idle than others, for changes in the styles of sweaters, bathing suits, or even golf stockings, may at any time alter demand to such an extent as to change completely the situation indicated in the tables. Obviously this problem is complex, but it seems equally obvious that the manufacturers in this group will profit from a careful study of the manufacturing equipment to be found not only in their individual plants but also in the industry as a whole.

TABLE B.—DEGREE OF ACTIVITY OF EQUIPMENT

Per cent of normal working time in use, July to December, 1928	Circular machines		Flat machines	
	Number	Per cent	Number	Per cent
0	49	6	13	4
5	3	(1)	2	1
10	8	1	3	1
20	5	1	----------	----------
25	41	5	19	7
33⅓	----------	----------	2	1
40	3	(1)	----------	----------
50	307	38	75	27
60	----------	----------	5	2
75	92	11	54	19
80	65	8	8	3
90	4	(1)	12	4
95	2	(1)	13	4
100	217	27	66	23
125	9	1	----------	----------
150	----------	----------	13	4
Total	805	100	285	100
Unknown	348	----------	166	----------
Grand total	1,,153	----------	451	----------

[1] Less than one-half of 1 per cent.

IS THERE AN OPPORTUNITY FOR SIMPLIFICATION?

Table C raises a question as to whether it might not be possible to reduce the overhead costs of the industry by decreasing the variety of sizes or other features of machines employed, and whether, if this were done, it might not also serve to lower the costs of manufacturing such machinery through simplifying the problems of the machinery builders; that is, as a result of simplication, machinery manufacturers might find it unnecessary to produce such a wide range of equipment or to maintain as many repair parts and as great a servicing organization as are now needed. The variety of sizes of machines in use in Philadelphia is striking. It will be observed that among the circular machines 29 different sizes were in operation for the various diameters up to 36 inches. Certainly there appears to be only a very limited demand for the 26-inch, 32-inch, and 36-inch diameters. Perhaps it would be found that certain other sizes of circular machines are superfluous.

If one considers only those circular machines which operated full time, or over, as shown in Table 11, it will be seen that the busy equipment includes mainly the 3-inch machines, those ranging in size from 11¼ to 21 inches, and the 28-inch machines.

Similarly, Table C shows that 31 widths of flat machines ranged from 2 to 100 inches, but most of the machines were concentrated in 11 or 12 of these sizes, suggesting that perhaps one-half of these widths could be eliminated.

TABLE C.—SIZES OF MACHINES EMPLOYED

Circular machines			Flat machines		
Diameter in inches	Number	Per cent	Width in inches	Number	Per cent
Up to 1	21	2	2 to 5	3	1
1½ to 2	47	4	9	2	1
2⅛ to 3	98	9	10	19	6
3¼ to 4	52	5	11	1	(1)
4¼ to 5	56	5	12	20	6
5¼ to 6	22	2	14	6	2
6¼ to 7	10	1	16	23	7
7¼ to 8	10	1	18	32	9
8¼ to 9	14	1	20	38	11
9¼ to 10	31	3	21	1	(1)
10¼ to 11	16	1	22	20	6
11¼ to 12	42	4	23	1	(1)
13	27	2	24	27	8
14	62	6	25	2	1
15	38	3	26	18	5
16	96	9	27	1	(1)
17	37	3	28	9	3
18	86	8	30	4	1
19	58	5	31	2	1
20	68	6	32	43	13
21	47	4	33	1	(1)
22	30	3	34	6	2
23	16	1	36	12	4
24	13	1	37½	6	2
26	2	(1)	40	7	2
28	21	2	44	5	2
30	81	7	45	4	1
32	1	(1)	48	3	1
36	2	(1)	52	1	(1)
			80	3	1
			100	10	3
Total	1,104	100	Total	330	100
Unknown	49		Unknown	121	
Grand total	1,153		Grand total	451	

[1] Less than one-half of 1 per cent.

IS THE MACHINERY ADEQUATE?

After a complete inventory of the machinery in these 32 factories had been made, the question arose as to the effectiveness of this equipment. As already stated, the information gathered in the survey, including data on the sort of fabric and garment being produced by each machine, was placed in the hands of a group of competent manufacturers thoroughly conversant with the details of all fabrics made and the details of all models of machinery available to the industry, in the hope that they could determine the extent to which each machine fell short of the best equipment available in the market for a given operation. They supplied a series of percentage ratings, summarized in Table D. These ratings represented their opinion as to the effectiveness of each machine in the survey.

While perhaps no two persons would agree in making an analysis of this kind, and consequently the work of any such committee can be criticized, it is at least striking to note the lowness of the ratings, particularly the lowness of the ratings given flat machinery. Seventy-nine per cent of the circular machines and 98 per cent of the flat machines were rated 20 per cent or below. Even though other persons studying the survey data might wish to alter materially the ratings established by this committee, these figures at least suggest that the industry should give careful consideration to the condition of its manufacturing equipment.

TABLE D.—EFFECTIVENESS OF EQUIPMENT IN USE

Rating (per cent)	Circular machines		Flat machines	
	Number	Per cent	Number	Per cent
0	27	2	59	14
5	233	20	263	61
7½	72	6		
10	105	9	4	1
15	101	9	51	12
20	371	33	44	10
25	99	9	1	(1)
30	27	2	2	(1)
33	24	2	2	(1)
40	12	1	5	1
50	3	(1)		
65	47	4		
75	26	2		
Total	1,147	100	431	100
Unknown	6		20	
Grand total	1,153		451	

[1] Less than one-half of 1 per cent.

In presenting the ratings the Department of Commerce merely hopes to encourage attention to the problems involved. Clearly it is not in a position to accept responsibility for these ratings or for any conclusion that might be based upon them.

I. ANALYSIS OF SURVEY DATA

METHOD OF ANALYSIS

In interpreting the survey data as represented by the tables which appear in the appendix of this study, no attempt will be made to analyze every table. Rather the attempt will be to bring out the principal points which the tables suggest. In general, since there are relatively few flat machines compared with circular machines, the relationships between the different categories of data on the flat machines tend to be much less clearly defined than in the case of the circular machines. Consequently, the flat machines will receive less attention in the analysis.

In tabulating the data the major amount of attention was given to six points—secondhand purchase, rebuilding, idleness, age, style, and size. Fewer tables were prepared for other points covered by the census card, and for certain points no tables at all were prepared, for reasons explained below. The appendix contains a reproduction of the census card (p. 55), showing all the categories of information asked for in the survey.

For maximum clearness and convenience of use, the tables made up from these data were arranged in two sections. Each table in the first section (in Roman numerals) presents a summary of the data covering an individual item on the census card,[1] grouped both by number of machines and by percentages, and contrasts circular and flat machines, the same or corresponding information being shown for both types. The percentages in the summary tables were figured only on the number of machines for which data on the item in question were available. The tables in the second section (in Arabic numerals) represent various combinations of items; that is, the relationship of different items to each other.[2] The following analysis will take account of both summary and detailed tables.

This analysis does not, of course, contain as much detail as do the tables themselves. Special attention is directed to the index (p. 25), by which the reader may immediately find the summary table for any item, or any combination of items, contained in the detailed tables. For this reason it has been deemed unnecessary in the following text to refer to the numbers of the detailed tables, only the numbers of the summary tables receiving attention.

A complication inherent in this sort of presentation should be mentioned, namely, that if one analyzes separately under the heading of each item all the important relationships of that item to other items, one must make every analysis a second time. For instance, in the following discussion, under the heading Idleness, the relation of the age of a machine to its average idleness is considered at some length. A little later, under the heading Age, it would be necessary to repeat the same analysis if all the important relationships of age to other items are to be shown. Obviously, however, such frequent repetition is undesirable. The discussion of relationships of items, consequently, will be limited mainly to the first few items, but as the index on page 25 is cross classified, the reader can find any relationship for which a tabulation has been made by looking up under either of the items concerned.

INCOMPLETENESS OF DATA

In many cases it was impossible to secure complete and accurate answers to the various questions on the census card. For instance, the data regarding the speed of the machines frequently represented only guesses. Very few plants were able to state more than approximately the hours their equipment had been operating during the second half of 1928. Very few plants knew accurately whether they had purchased their machines new or secondhand, how long the machines had been in the plant, or whether important changes had been made in the machines since purchase. In some instances the manufacturer's serial number for a machine could not be obtained. Many of the machines represented in the tables in the appendix, although actually in the plant and available for use, were not employed at the time of the survey. Some of them were not even belted to power shafting for operation, but had been set aside temporarily or permanently in the hope that use for them might subsequently develop. The data collected on these temporarily or permanently discarded machines were very scanty. In some instances these machines were so stored as to make inspection impossible. However, in an effort to make the inventory represented by this report as complete as possible, data were collected covering all machines on the premises of the 32 plants visited, whether or not they were in operation or even belted up at the time of the survey.

The data on speed, particularly, represented so largely guesswork that no tables on speed have been included in this study. Certain machinery experts have suggested that perhaps the industry could benefit by giving greater attention to the question of whether the machines operate at the most favorable rate and whether the driving speeds are steady, for fluctuating drive speeds may have a detrimental influence on both the rate of production and the quality of product.

Other items appearing on the census card which are not tabulated herein are (1) yarn sizes for both circular and flat machines, (2) stripers for flat machines, and (3) whether operated by power or hand for circular machines. The reason for not tabulating yarn sizes is that the data asked for on the census card covered only maximum and minimum sizes used and did not easily lend themselves to tabulation. The number of stripers on flat machines was not tabulated because it is understood that stripers are the same as yarn changes. The item of whether a circular machine was power or hand operated was not tabulated because it is understood that all circular-knitting machines used in the outerwear industry are run by power.

The data on the remaining items were tabulated, but there are many gaps. In the summary tables in the appendix the large percentage of machines for which data were not available will be immediately noticed. For instance, the owners of one-fifth of the circular machines covered by the survey did not know whether they had purchased these machines new or secondhand. The percentage of unknowns varies considerably for the other items called for on the inventory card, but it is large in every instance. It is usually larger for the flat machines than for the circular. Unless otherwise specified, the proportional figures and other comparisons in the following text are based solely on the number of machines for which data on the item being discussed were available, leaving out of consideration the machines with data on that item lacking.

---

[1] Except Table XVII, which presents the ratings supplied by the cooperating committee of the industry.

[2] The tables from No. 23 to the end cover the relationship of the committee's ratings to various items of the survey data.

ANALYSIS OF POINTS COVERED

MAKE

Table I (p. 26) shows that four makes account for 83 per cent of the circular machines of known make represented in this survey. Among the flat machines, 56 per cent were of one make and 19 per cent of another. In both circular and flat machines the remaining units represented a relatively large number of makes, but the number of machines in each make was insignificant.

SECONDHAND PURCHASE AND REBUILDING

Table II (p. 27) shows that 31 per cent of the circular machines and 46 per cent of the flat machines for which data were available were bought secondhand. However, the probability is that practically all the machines classed as unknown were bought secondhand. If these unknown machines are counted as secondhand in computing the percentages, somewhere between 40 and 50 per cent of the circular machines and 60 per cent or more of the flat machines were bought secondhand.

The large proportion of equipment purchased secondhand suggests several questions for possible study, not only by manufacturers of knitted wear, but also by manufacturers of knitting machinery. Perhaps equipment is being sold to individuals who possess insufficient capital, or who for other reasons are not able to continue business successfully, with the result that after operating a little while their machines are found on the secondhand market. Such a situation, if it prevails widely, might demoralize both the knitted-outerwear business and the business of the manufacturers of knitting machinery. Obsolescence of knitted-wear styles also may be a factor in placing many machines for sale on the secondhand market. If investigation discloses that obsolescence of styles is the reason for the large proportion of secondhand equipment operating in Philadelphia, it will perhaps also be found that there is a very large amount of machinery for knitting outerwear available in the country, a factor which should be recognized by both the manufacturer and the user of the machines in handling their sales and accounting problems. Other reports suggest that knitting manufacturers, after purchasing secondhand machines, sometimes not merely repair them but remodel them and equip them with additional attachments, thus fitting them for improved production either in speed or in variety of output. Tables III and IV (p. 27) shed additional light on this question.

Table III shows that 21 per cent of the circular machines and 18 per cent of the flat machines for which data were available had been rebuilt. Table IV is a combination of the "breakdowns" made in Tables II and III.[3] This table shows that, as one would expect, among the circular machines a much larger percentage of those bought secondhand had been rebuilt than of those bought new. More than a third of the circular machines bought secondhand had been rebuilt, while only about a tenth of those bought new had been rebuilt. The proportion of flat machines bought new which had been rebuilt was about the same as of circular machines bought new, but only between one-sixth and one-seventh of the flat machines bought secondhand had been rebuilt. All comparisons made above in discussing Table IV are based on the totals of machines for which data on both purchase and rebuilding were available.

Certain points brought out in the detailed tables may be mentioned as throwing some light on the reasons for rebuilding.

Style.—Apparently the principal rebuilding of circular machines consisted of adding attachments to convert plain machines into pattern-wheel machines, in order to simulate a jacquard fabric, for only a small fraction of the plain and jacquard machines in Philadelphia at the time of the survey were reported as having been rebuilt, while half the pattern-wheel machines bought new (for which data on rebuilding were available) had been rebuilt, and five-sixths of those bought secondhand. Among the flat machines a greater proportion of the jacquard machines than of the plain machines were bought secondhand, but a greater proportion of the plain machines, both new and secondhand, were rebuilt.

Diameter.—Among the circular machines the medium-diameter machines were the only ones to be rebuilt in any quantity. The range of these diameters was from 9¼ to 21 inches.

Cut.—As regards number of needles per inch, more circular machines with a range of 7 to 7.8 needles per inch were found to have been rebuilt than those of any other similar range. This was particularly true in the case of the secondhand circular machines. Out of 59 secondhand circular machines with 7 to 7.8 needles per inch, 47 had been rebuilt. These 47 machines constituted more than half of the secondhand rebuilt circular machines of all cuts.

Needle.—Nearly one-fourth of the circular machines bought secondhand had spring needles, while only 3 per cent of those machines purchased new were so equipped.

Automatic or hand.—The flat semiautomatic machines, which were more than one-half of the total flat machines of known type of operation, constituted a much larger proportion of the machines bought new than of the machines bought secondhand. No hand-operated machines had been rebuilt. A larger proportion of full automatic than of semiautomatic machines had been rebuilt.

IDLENESS

Table V (p. 27) shows the average percentage of normal working time in use during the six months from July to December, 1928. The averages for all circular and flat machines for which data were available were 65 and 71 per cent, respectively.

The following table brings out the comparison a little more clearly:

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[3] The totals of knowns in Table IV are lower than in Tables II and III because of the greater number of unknowns; that is, for a machine to be listed in Table IV, data regarding both whether purchased new or secondhand and rebuilding needed to be available, while for listing in Tables II and III data on only one of these items needed to be available.

Per cent of normal working time in use, July to December, 1928	Per cent of machines	
	Circular	Flat
50 or more	85	86
75 or more	47	57
100 or more	28	27

It would have been desirable to obtain similar information for the whole calendar year 1928, instead of for half the year. For instance, machines working on bathing suits are likely to be used less at certain times of the year than at others. However, the last six months of the year were selected because they were naturally fresher in the minds of the manufacturers, and it was desired to avoid guesswork as far as possible.

The relationships of the idleness of the machines to various other features should be briefly discussed. Some of the points brought out are as follows:

Age.—The figures for both circular and flat machines suggest that the older a machine the less its activity, except that in the case of the circular machines the oldest of all (13 to 20 years in plant) did fairly well. If it is assumed that the "unknowns" operated less than 50 per cent of the time, the relation of age to idleness is summarized as follows:

Number of years in plant	Per cent of machines in use 50 per cent of the time or more	
	Circular	Flat
Less than 1	90	100
1 to 3	80	77
4 to 7	56	92
8 to 12	56	80
13 to 20	96	10

This comparison, however, is slightly misleading. It would indicate that among the circular machines the oldest machines ran best of all; but this was not the case, because the oldest machines had a much smaller proportion in the 100 per cent group than did the machines in the first three age groups. Nevertheless, the circular machines in the oldest group made a definitely better showing than did the circular machines in the 8 to 12 year group.

If one considers only the machines purchased new, and counts the machines of unknown degree of activity as operating less than 50 per cent of the time, the following results are obtained:

Number of years in plant	Per cent of new machines in use 50 per cent of the time or more		Per cent of new machines in use 75 per cent of the time or more		Per cent of new machines in use 100 per cent of the time or more	
	Circular	Flat	Circular	Flat	Circular	Flat
Less than 1	84	100	82	71	33	71
1 to 3	82	78	62	56	46	39
4 to 7	61	98	34	42	21	6
8 to 12	70	100	31	71	13	29
13 to 20	100	4	-----	-----	-----	-----

Style.—Among the circular machines the pattern-wheel and jacquard machines worked more of the time, on the average, than did the plain machines. Among the flat machines, on the other hand, the plain machines were more active than the jacquards. The following table sums up the situation. Again the machines of unknown degree of activity have been counted as operating less than 50 per cent of the time:

Style	Per cent of machines in use 50 per cent of the time or more		Per cent of machines in use 75 per cent of the time or more		Per cent of machines in use 100 per cent of the time or more	
	Circular	Flat	Circular	Flat	Circular	Flat
Plain	62	74	30	52	11	26
Pattern-wheel	64	-----	47	-----	43	-----
Jacquard	83	70	71	35	67	15

Size.—The circular machines with diameters ranging roughly from 10 to 22 inches operated the largest proportion of normal working time during the period July to December, 1928. With the flat machines there was not, as there was with the circular machines, a tendency for a certain range of sizes to work a greater proportion of normal working time than the remaining sizes. Little relation between width and idleness can be discerned.

Cut.—Apparently the number of needles per inch did not make much difference in the time worked, either by circular or by flat machines.

Feeds.—On the whole, the more feeds a circular machine had, the more it worked.

Yarn changes.—The flat machines with 4 and 5 yarn changes were in use the largest proportions of time, but the flat machines with no yarn changes were in use considerably more than the machines with 1, 2, or 3 yarn changes.

Raw materials and products.—The nature of the raw materials used by either circular or flat machines did not seem to bear much relation to idleness, presumably because of the ease with which machines may be transferred from one raw material to another. Among the circular machines the 29 machines working on artificial silk showed the best ratio of activity, presumably because of the recent vogue for artificial-silk fabrics. They worked 100 per cent of the normal working time. Similarly, the circular machines making (1) sweaters and ladies' suits, (2) ladies' wear, and (3) golf hose all ran 100 per cent of the time. However, there were only 15 circular machines on these three categories of products. This situation again suggests the effect of changing styles on demand and the significance of style obsolescence. Seven out of eight circular machines making sport coats and sweaters ran 100 per cent of the normal working time. On the circular machines, bathing-suit machines ran long compared with those making (1) sweaters and (2) sweaters and bathing suits. Machines making cloth had a high average of idleness.

AGE

Table VI (p. 28) shows that slightly over one-third of the circular machines on which such information was obtained had been in their present plants from 4 to 7 years. Almost one-third had been in their present plants 3 years or less, and almost one-third 8 years or more. Among the flat machines on which such data could be secured, slightly more than a third had been in their present plants 3 years or less, less than a third from 4 to 7 years, and slightly more than a third 8 years or over. Some of the flat machines were very old, 10 of them having been 50 years in their present plant. Of course, such of these machines as were purchased secondhand were actually older than these returns would indicate, but there appears to be no way of knowing how much older. Moreover, the large number of machines of unknown age in present plant as shown in Table VI, were also probably far from new.

In the previous discussion, the relationship of various important items to age has already been brought out. A word should be added on the relationship of age to style.

Style.—The oldest circular machines were practically all plain. Of the circular jacquard machines, 17 per cent were less than 1 year old and two-thirds were from 1 to 3 years old. A third of the flat jacquard machines were less than a year old in their present plant, in comparison with less than 5 per cent of the flat plain machines.

The appendix contains tables (see index, p. 25), not discussed here, which bring out the relationship of the age of the machines bought new by their present owners to certain other features of the machines.

Size.—One of these tables suggests that among the circular machines certain diameters are less well adapted than they were some years ago to the production of the style of garments in greatest demand. For example, there had been an insignificant number of new machines of diameters between 5¼ and 14 inches installed during the three years prior to the survey, a fact which may prove significant if efforts are made to eliminate some of the sizes of machines that have been manufactured. Only two new 30-inch circular machines had been installed during the eight years prior to the survey, and yet these were installed less than a year before these figures were collected. It is important to study the relation of these different diameters to trends in style demand.

Cut.—Of the circular machines bought new by their present owners, those with the smallest numbers of needles per inch—up to 3.7—were practically all from 4 to 12 years old. Of those less than 1 year old, 27 out of 45 had from 10 to 10.7 needles per inch. Of those 13 to 20 years old, 30 out of 38 had from 8 to 8.5 needles per inch.

STYLE

In developing the data for Table VII (p. 28) a jacquard machine was considered as a machine that can make geometric patterns of any size, shape, or color, symmetrically and uniformly. Usually it can make designs whose shape and area are limited only by the size of the fabric being produced. It does not mean that these patterns are necessarily angular or repetitive. In fact, the wearer's signature can be reproduced in his hosiery if so desired. A circular pattern-wheel machine, although hard to differentiate sharply from a circular jacquard machine, was considered as one that can make designs of limited shape and area and which ordinarily does not produce symmetrical or uniform patterns. It is possible that in obtaining the data for Table VII certain pattern-wheel machines were reported as jacquard machines, but, at any rate, this table indicates that 76 per cent of the circular machines and 88 per cent of the flat machines for which particulars were available were plain machines. There is also reason to believe that most of the machines for which information was not available were plain machines.

Rebuilding.—It will be recalled that apparently the principal rebuilding in the case of circular machines consisted of adding attachments to convert plain machines into pattern-wheel machines, in order to simulate a jacquard fabric.

Size.—The plain machines were fairly well distributed over all the diameters. The circular pattern-wheel machines were practically confined to the middle diameters—from 9¼ to 20 inches. The circular jacquard machines, except for one machine of 32-inch diameter, all had diameters from 14 to 28 inches. The flat plain machines were of almost every width. The 40 flat jacquard machines were from 16 to 40 inches wide. Nine of them were 20 inches wide, and 10 were 32 inches wide.

Cut.—The circular plain machines were well distributed as to number of needles per inch, 8 to 8.5 needles per inch being the main range of cut. Out of 178 circular pattern-wheel machines, 90 had 7 to 7.8 needles per inch. The circular jacquards were mainly in the medium cuts, from 7 to 10.7 needles per inch. Nearly half of the 285 flat plain machines had 2½ needles per inch. The remaining flat plain machines varied from 3 to 18 needles per inch. The flat jacquard machines also varied from 2½ to 18 needles per inch, but they had a smaller variety of cuts.

Feeds.—The circular plain machines had all numbers of feeds. The circular pattern-wheel machines had mainly 2 or 4 feeds. The circular jacquards all had 4, 6, or 8 feeds, more than half being 4 feed.

Striper changes.—Out of 817 circular plain machines, 550 had no striper changes. Over half the circular pattern-wheel machines had two striper changes each. The circular jacquards had mainly four or eight striper changes each.

Yarn changes.—Nearly half the flat plain machines had no yarn changes, while the flat jacquard machines had from two to five yarn changes. Only one flat plain machine had five yarn changes, while seven flat jacquard machines had five yarn changes each.

SIZE

Table VIII (p. 28) may indicate an opportunity for simplification of sizes. There was a great variety of diameters and widths of the machines in the survey, and the different sizes were fairly evenly distributed, especially in the case of the circular machines. The machines of the smallest diameters and widths are used primarily for making trimmings.

In addition to the relationships of other features already discussed to size, the following may be mentioned.

Cut.—The greater the diameter of a circular machine, the greater the number of needles per inch. This may be qualified, however, by saying that a considerable number of the circular machines with the smallest diameters (up to 5 inches) had from 8 to 12 needles per inch. The various cuts were fairly widely distributed among the different widths of flat machines. There did not, as in the case of the circular machines, seem to be a tendency for the number of needles per inch to increase with the size.

Feeds.—Roughly speaking, it may be said that the greater the diameter of a circular machine the greater the number of feeds.

CUT, FEEDS, AND STRIPER AND YARN CHANGES

Table IX (p. 29) reveals that the circular machines were primarily medium-cut machines. Sixty-nine per cent of those of known cut had from 7 to 10.7 needles per inch. (The decimal numbers used in Table IX were employed because in many instances the inventory showed only the total number of needles, and it was necessary to compute the needles per inch from the total needles and the diameters.) The flat machines averaged much coarser in cut[4] than the circular machines; 40 per cent of the flat machines of known cut had only 2½ needles per inch, having produced primarily shaker sweaters.

Table X (p. 29) shows that 31 per cent of the circular machines of known number of feeds had 2 feeds each, 19 per cent had 8 feeds, 18 per cent had 5 feeds, and 12 per cent had 4 feeds.

Table XI (p. 29) brings out the fact that over half the circular machines of known data possessed no striper changes and that 39 per cent of the flat machines possessed no yarn changes.

The more significant relationships of these items to other items have already been discussed.

TYPES OF STITCH AND NEEDLE

Table XII (p. 30) indicates that more than two-thirds of the circular machines for which full information could be obtained employed the rib type of stitch. The machines classed as jersey stitch included shaker machines.

Table XIII (p. 30) shows that 92 per cent of the circular machines of known type of needle were latch-needle machines.

The relationship of type of needle to secondhand purchase has already been discussed.

It should be mentioned that in spite of the fact that rib machines are far in the lead in total circular machines, machines with a jersey stitch predominate greatly in the diameters up to 2 inches and in the 30-inch diameter. Spring needles appeared only in the circular machines with diameters 17 inches and over, and 70 out of a total of 84 circular machines with spring needles were 30-inch diameter machines.

AUTOMATIC OR HAND-OPERATED

Table XIV (p. 30) shows that more than half of the flat machines of known type of operation were semiautomatic. As stated above, all the circular machines were run by power, and were thus automatic.

The relationship of type of operation of flat machines to the question of secondhand purchase and rebuilding has been discussed. Its relation to style and width should also be mentioned.

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[4] The number of needles per inch on flat machines is frequently called "gage," but for convenience in comparison with circular machines it is called "cut" in this report.

Nine flat jacquard machines were hand operated, and 26 were full automatic; none was semiautomatic. The greater part of the flat plain machines were semiautomatic.

The hand-operated machines were mainly from 10 to 20 inches wide. The automatic and semiautomatic machines were more widely distributed among the different widths.

RAW MATERIALS AND PRODUCTS

Tables XV and XVI (pp. 30 and 31) summarize the raw materials and products of the machines studied. In interpreting them and the detailed tables containing the same items, it should be remembered that the machines are very flexible both as to raw materials used and as to products. The information presented here merely describes the situation as it existed at the time the survey was made. The dates of gathering the information, as stated above, were spread out during a period of nearly four months, on account of the time required to visit the 32 plants. Conditions might be different another year, or even another month, depending largely upon style changes in the product.

Table XV indicates that 51 per cent of the circular machines were working on worsted alone and 22 per cent of them on cotton and worsted together. It is impossible to say whether cotton and worsted were used at different times or were made up together into the same fabric. There was a much more even distribution of raw materials among the flat machines.

Table XVI shows that of the three following categories of products, each represented about one-fourth of the circular machines of known product: (1) Sweaters, (2) sweaters and bathing suits, and (3) trimmings. The important products of the flat machines were (1) shaker sweaters, (2) trimmings, and (3) sweaters.

The relationship of the nature of raw materials and products to the degree of idleness has already been considered.

Size.—The circular machines of the smallest diameters produced mainly trimmings, those of medium diameter mainly sweaters and bathing suits, and those of largest diameter mainly cloth. The flat machines less than 12 inches wide produced mainly trimmings, those from 12 to 32 inches wide mainly shaker sweaters and trimmings, and those above 32 inches mainly sweaters and shaker sweaters.

II. RATING OF THE MACHINES

METHOD EMPLOYED

As previously stated, a committee representing the knitted-outerwear industry rated each machine covered by this study, using for the purpose the data collected in the survey. In arranging the data for the use of the committee, care was taken that the activities of individual manufacturers should not be disclosed. The Department of Commerce did not participate in establishing these ratings, and the publication of them in this study should not be construed as involving the department's approval of them. They are merely presented for what they may be worth as the best information that could be assembled on the subject. They represent the judgment of knitted-outerwear manufacturers conversant with the details of the fabric being produced and with the various models of machinery available to the industry for such production.

The rating committee states that it desired to assign to each machine covered by the survey of rating which would represent both obsolescence and depreciation, and that, had the complete information necessary for a close calculation of ratings been available, it would have proceeded as follows:

To provide for mechanical obsolescence (resulting from new inventions in knitting machinery), it would have compared the cost of production on the machine being rated with the cost of production on the latest or most efficient model producing exactly the same product. The latter would be rated 100 per cent. The rating of the machine under consideration would be computed by dividing the cost of producing on the latest model by the cost of producing on the machine being rated.

To provide for style obsolescence (resulting from changes in styles of knitted garments) the committee would have compared the profits (not the cost) from producing on the machine being rated with the profits which would accrue from producing on that machine if the demand for its product were the same as at the time the machine was manufactured. This ratio might possibly be over 100 per cent, but, of course, it would normally be less, as styles of products seldom return to vogue in such entirety that older models of machines are better adapted than new ones to produce them.

The rating for depreciation, that is, for age, could probably be determined in a manner similar to that for mechanical obsolescence. The cost of producing on the machine being rated would be divided into the cost of producing on a new machine of exactly the same model.

The question of the adaptability of machines to the particular plants where they are located was, of course, not considered by the committee, as the data sheets used by the committee did not show who owned the machines being rated. In the same way, the question of proper care of the machines was left out of consideration. That is, it was assumed that all machines being rated, with the exception of certain cast-off machines, were in good running order and had received good care. Likewise, of course, it was necessary to assume equality in the efficiency of management in the 32 plants containing the machines being rated.

Then the three independent percentage ratings, as indicated above, would be multiplied together to get the final efficiency rating for the machines. For instance, a machine might be rated 75 per cent on mechanical obsolescence, 50 per cent on style obsolescence, and 50 per cent on depreciation. Its final rating then would be 75 per cent times 50 per cent times 50 per cent, or 18¾ per cent.

In actual practice the committee states that only rough estimates were possible for each of the three factors. As regards mechanical obsolescence, it took into consideration the approximate relative costs of producing on the machine being rated and on the most efficient model outstanding. As regards style obsolescence, it estimated the percentage decline in demand for the product of the machine being rated. To cover depreciation it used a 20-year straight-line depreciation factor. That is, a machine was regarded as losing 5 per cent of its original value each year, independent of the question of obsolescence. This 5 per cent, then, the committee regarded as a part of the cost of operating the machine for any specified year. It turned out, moreover, to be impracticable to provide ratings for all three of these factors separately. Hence, the committee fixed on a single percentage rating for each machine which would represent approximately the combined effect of mechanical obsolescence, style obsolescence, and depreciation. The rating assigned to a machine by the committee may then be summed up as reflecting the ability of that machine to make profits for its owner, compared with an entirely new machine with the latest technical improvements and manufacturing a product which is in full market demand.

ANALYSIS OF RATINGS

Table XVII (p. 31) summarizes the ratings given both to the circular and to the flat machines. The most salient feature is their lowness. Next is the fact that the flat machines are rated considerably below the circular machines. The following table brings out the comparison perhaps more clearly for all the machines which were rated.

Rating	Per cent of machines rated	
	Circular	Flat
20 per cent or below	79	98
5 per cent or below	22	75

Below is a brief analysis of the detailed tables of ratings in the appendix.

CIRCULAR MACHINES

No secondhand machine received a rating above 25 per cent, while 18 per cent of the new machines received ratings over 25 per cent. The rebuilt new machines were not rated higher than the other new machines, but the rebuilt secondhand machines were, on the average, rated higher than the others. The following table brings out the situation relative to rebuilding.

Rating	Per cent of new circular machines		Per cent of secondhand circular machines	
	Rebuilt	Not rebuilt	Rebuilt	Not rebuilt
75 per cent or below	100	100	100	100
25 per cent or below	72	80	100	100
10 per cent or below	29	34	12	61

There was, of course, a general tendency for the ratings of machines to increase with the increase in the degree of activity during the period July to December, 1928, but there were a good many exceptions to this rule. For instance, slightly less than one-half of the machines in use 25 per cent of the time were rated at 15 per cent or lower, while 62 per cent of the machines in use 50 per cent of the time received ratings of 15 per cent or lower. It is noteworthy that 40 per cent of the machines in use all of the normal working time received a rating of 20 per cent or lower.

Also, as a general rule, the longer a machine had been in its present plant, the lower was it rated. However, 43 per cent of the machines which had been the property of their present owners for less than a year were rated at 7½ per cent or below. These machines had probably been purchased secondhand.

The tabulations show that, with very few exceptions, the greater the diameter, the greater the rating. The most important exception is that 70 out of 81 machines of 30-inch diameter were rated at only 7½ per cent.

Apparently the number of feeds was not one of the major considerations of the rating committee, for although a very general tendency to assign higher ratings to machines with more feeds is discernible, the exceptions are many and important. For instance, 36 per cent of the machines with four feeds were rated at 65 or 75 per cent, while no machine which was definitely known to possess eight feeds was rated higher than 50 per cent, and the eight machines definitely known to possess 12 feeds were rated at 20 and 25 per cent.

The number of needles per inch was evidently not an important factor in the rating, for the various ratings are fairly evenly distributed among the various cuts. In a very general way, however, it may be said that the larger cuts tended to receive the higher ratings. For instance, no machine below 5 needles per inch received a rating above 15 per cent.

FLAT MACHINES

The flat machines definitely reported as having been purchased secondhand were rated higher, on the average, than those purchased new. Thus 84 per cent of the machines reported as bought new were rated at only 5 per cent, while 44 per cent of the machines reported as bought secondhand were rated at 15 per cent or above. However, the average rating of the secondhand machines would probably be considerably lower if the unknowns should be included among them and arranged according to their ratings. For instance, 59 machines—or over one-eighth of the total flat machines for which data as to purchase were not available—were rated at zero. The nonrebuilt machines which were definitely known to have been purchased new or secondhand were rated higher, on the average, than the rebuilt machines. The following table shows the rating situation relative to rebuilding:

Rating	Per cent of new flat machines		Per cent of secondhand flat machines	
	Rebuilt	Not rebuilt	Rebuilt	Not rebuilt
5 per cent or below	89	80	76	50
15 per cent or above	11	20	24	47

There was, of course, a tendency for the ratings of machines to increase with the increase in the proportion of normal working time they operated during the period July to December, 1928. However, there were important exceptions to this general rule. For instance, 108, or 41 per cent, of the 263 machines rated at 5 per cent worked from 75 to 150 per cent of the time. It will be recalled from Tables V and XVII that the flat machines averaged at least as high as the circular machines in time operated, and that there was as great a proportion of the flat machines operating 50 per cent of the time and over as of the circular machines, and yet that the flat machines in general were rated considerably lower than the circular machines. Thus it seems probable that the idleness of flat machines weighed less with the rating committee than did that of circular machines.

A general tendency to rate machines in inverse proportion to their age is also discernible, yet many machines which had been only a short time in their present plant received very low ratings. These, however, were probably secondhand machines.

The width of a flat machine apparently had no connection whatsoever with the rating. There was no tendency for low, medium, or high ratings to be grouped among particular groups of widths.

There was a definite tendency for ratings to increase in proportion to the number of yarn changes.

The machines with from 6 to 12 needles per inch, on the whole, received the highest ratings.

III. CONCLUSION

SUMMARY OF SURVEY DATA

This survey has brought out the great variety of ages, models, sizes, cuts, number of feeds, and other features connected with knitting machines used in the knitted-outerwear industry of Philadelphia. Some of the more important points are given below.

Of the circular knitting machines covered by the Philadelphia survey, 76 per cent were plain, in spite of the fact that a large proportion of the pattern-wheel machines covered by the survey had been converted from plain to pattern wheel. Of the flat machines of known type covered by the survey, 88 per cent were plain. The proportion of plain circular machines, eight years or more in the present plant, was much larger than of pattern-wheel or jacquard circular machines. For the three styles in question the ratios were 38, 7, and 11 per cent, respectively. The jacquard circular machines had the greatest ratio of relatively recently purchased machines—89 per cent of those for which data were available were less than 3 years old in their present plants. Among the flat machines those of jacquard style averaged considerably fewer years in their present plant than did the plain machines. For instance, a third of the flat jacquard machines had been less than a year in their present plant, compared with less than 5 per cent of the flat plain machines.

Among the circular machines the jacquard and pattern-wheel machines operated greater proportions of normal working time during the period July to December, 1928, than did the plain machines. Interestingly enough, the flat plain machines ran more of the time than did the flat jacquard machines.

More than 40 per cent of the circular machines and 60 per cent or more of the flat machines were bought secondhand by their present owners.

About a third of both the circular and the flat machines for which data on length of time in present plant were available had been in their present plant for eight years or more. Many of these machines had been bought secondhand and consequently were older than the records of the reporting plants indicated. Moreover, it is probable that a large number of machines, both circular and flat, for which no age data were available were fairly old. The outstanding example of age was the case of 10 flat machines, comprising 4 per cent of the total flat machines of known number of years in present plant, which were bought secondhand 50 years ago by the plant now owning them. A comparison of the ages of machines, both circular and flat, with their idleness during the period July to December, 1928, shows that, with some exceptions, the older a machine, the less it was in operation.

There was such a great variety of diameters of circular machines and widths of flat machines as to suggest studying the possibility of gain from simplification of sizes. Similarly, there was a great variety in the reported speeds, particularly of the circular machines, and much guesswork in reporting them, suggesting the desirability of studying speeds with a view to obtaining greater efficiency from standardization of speeds, or from altering in various ways the present speeds of machines.

More than half the circular machines for which data were available possessed no striper changes, while 39 per cent of the flat machines for which data were available possessed no yarn changes.

Forty per cent of the circular machines had not more than two feeds. A comparison of the number of feeds possessed by circular machines with the proportion of normal working time they were in use indicates that, as one might expect, the more feeds a machine possessed, the more it worked.

SIGNIFICANCE OF THE SURVEY

These facts hint at a considerable variation in efficiency among the knitted-outerwear machines in use in Philadelphia, but they hardly provide definite answers to the questions which the survey set out to try to answer. They show a large percentage of fairly old machines, a large percentage of relatively idle machines, a large percentage of machines with cuts (needles per inch) which at the time of the survey produced a fabric which had become less popular than formerly, a large percentage of circular machines with not more than two feeds, a larger percentage of machines with relatively little flexibility as to the type of fabric and design they could produce, and other features in which, perhaps, many of the machines failed to equal the most modern machines of their type available. Conceivably, many of these machines should be replaced or, at any rate, rebuilt or equipped with special attachments. Possibly there should be some simplification of sizes.

Until definite production-cost information by individual machines is available, however, in relation to the trend of style demand for their products, it can not be scientifically determined just when a machine should be replaced. The cost of a new machine or of rebuilding or adding special attachments to the old machine might add more to the cost of producing the knitted garment than the greater efficiency of the new machine or the improvement would decrease the cost of production, particularly if there is any danger of the market failing to absorb immediately, or at the same price as before, the additional goods which would result from the increased efficiency. And, of course, the production cost of the new machine compared with the old would be especially great where the new machine replaces an old one which was reserved for merely occasional use on specialized jobs; that is, periods of idleness are frequently more costly to a new machine than to an old one whose capital cost has already been largely written off. On the other hand, the changes in style demand for knitted garments which may have taken place since the purchase of the old machine may render that machine unprofitable to keep, however low its cost of operation may be compared with the latest model.

It should not be overlooked, however, that such facts as have been brought out in this survey naturally mean much more to the seasoned manufacturer of knitted outerwear then they do to a layman. This is demonstrated by the unanimity with which the members of the committee of the industry who rated the machines report that they agreed on the different ratings. These ratings, even though they may seem in some instances unduly low, provide expert testimony to the belief that some of the machines are much less efficient than others in their ability to produce profits for their owners.

Nevertheless, it remains for the future to indicate definitely what models, sizes, cuts, etc., of machines are the best adapted to particular types of work and to demonstrate, if possible, at what stage in particular cases it pays to replace an old machine with a new one.

NEED FOR ADDITIONAL DATA

Certain lines of research may be fruitful in the future in building up a store of information to aid in formulating scientific machinery replacement policies. Two general types of inquiry first suggest themselves. One involves compilation of production-cost data by individual machines. The other involves studies of market demand for knitted garments, particularly studies of the nature and extent of consumer preferences for different types and styles. This might involve studying the elasticity of demand, that is, the tendency of demand to increase or decrease with decreases or increases of price.

The difficulties of making these studies are many and obvious. It is hard to separate production-cost data for different machines. Indeed, it is hard enough to get a comparable measure of output between different machines, to say nothing of the complications of charging against a machine that part of the capital cost, upkeep cost, material cost, direct labor cost, indirect labor cost, and other indirect costs which properly attach to it. It must always be remembered that the same machine may work on varying materials and produce varying types of fabric at varying speeds. It may be used for a regular line of work, or it may be reserved for an occasional order for a special type of goods.

Another complication is the varying adaptability of the same machine to different types and sizes of knitting plants; that is, a machine whose use would be profitable in one plant is not necessarily profitable in all plants. For instance, it may pay a large plant to scrap a machine which would still be worth retaining in a small plant.

The nature of the work performed by a plant may change to such an extent that, independent of whether new models have been invented or demand for products changed, a different kind of machine becomes better suited to that particular plant. To take an illustration from outside the knitted-outerwear industry, a shop formerly doing general job work may possess a universal milling machine which rendered most efficient service for general job work. The shop changes the nature of its work and begins to concentrate on one particular line of product, which, although calling for some degree of milling, involves only one simple operation constantly repeated. A plain machine is now better adapted to the purpose of the plant, even though the universal machine may be just as up to date as it ever was for general job work.

Still another obvious complication is the difficulty of measuring the human factor of varying efficiency of management, which makes the same machine operate at different degrees of profitableness on the same type of work in different plants.

Then, even if it were possible to find machines where a reasonably satisfactory allowance for all the complicating factors just suggested could be made, there will always remain the necessity for expending additional time, trouble, and cost in setting up records to obtain the required cost data by individual machines.

No comment is needed here on the difficulties of studying the ability of the market to absorb different amounts of style fabrics at different prices. Such calculations can, of course, never get beyond approximations and must continue to depend primarily upon the alertness and merchandising ability of the individual manufacturer.

The statement of some of the obstacles does not, however, necessarily mean that they are insuperable. The method suggested above, in spite of the obstacles, may be a fruitful avenue for future research. Of course, the same principles apply in greater or less degree to all industries using machinery. The important thing for all these industries is to get thoroughly in mind the principle of figuring the cost of producing on different ages and models of machines in relation to variations in style demand and to the possible effect on market price of varying the supply of the product. It is to be hoped that further experiments in obtaining the needed data will take place, and that though they may never succeed in making a machinery replacement policy a matter of precise mathematical computation, they may gradually eliminate much of what at the present time is unavoidable guesswork in the matter of discarding and replacing machinery.

Such efforts are unquestionably worth while to society, for they tend to reduce waste. Producers will gain by adding to profit that which is saved through this reduction of waste. Consumers will gain by obtaining a more satisfactory service, a product of higher quality at no greater cost, or a product of equal quality at less cost.

APPENDIX

This appendix contains, in addition to the summary tables, tabulations of some of the more important relationships between the different items of data gathered in the survey. But, of course, these are only a few of the possible combinations. Persons interested may obtain from the Bureau of Foreign and Domestic Commerce additional "breakdowns" of the survey data in more detail if they desire. For instance, a person contemplating the purchase of a machine for making bathing suits might find it valuable to know in detail the different cuts of the machines that worked on bathing suits in Philadelphia in the second half of 1928. Such data will be supplied upon request.

Each table in the first section of this appendix (Tables I to XVII) presents a summary of the data covering an individual item on the census card, grouped both by number of machines and by percentages, and contrasts circular and flat machines, the same or corresponding information being shown for flat machines as for circular. As explained before, however, no tables were prepared for speed and yarn sizes for circular and flat machines, stripers for circular machines, and whether automatic or hand operated for flat machines. The final table (No. XVII) summarizes the ratings supplied by the cooperating committee of the industry.

The percentages in the summary tables were figured only on the number of machines for which data on the item in question were available.

The tables in the second section represent various combinations of items; that is, the relationship of different items to each other. Each combination is, of course, listed in the index under both items concerned. It will be noted that some of the tables contain more than one combination each. Tables 1 to 22a cover only items gathered in the survey, while Tables 23 to 28a cover the relationship of a few of these items to the ratings supplied by the cooperating committee.

In certain tables of the second section the figures showing the number of machines for each item do not add horizontally to the total shown. The difference represents the number of machines for which it was not possible to obtain information as to the particular point tabulated.

INDEX TO TABLES

CIRCULAR MACHINES

Subject	Table No.		Page
	Summary	Detail	
Make	I		26
Secondhand purchase and rebuilding	II–IV		27
Relation to—			
Idleness		1	32
Age		2	32
Style		3	33
Diameter		4	33
Needles per inch		5	35
Feeds		6	36
Striper changes		7	36
Types of stitch and needle		8	37
Rating		23	50
Idleness	V		27
Relation to—			
Secondhand purchase and rebuilding		1	32
Age		9	37
Age (new machines only)		10	38
Style		1	32
Diameter		11	39
Needles per inch		12	40
Feeds		13	41
Raw materials		14	42
Products		15	42
Rating		24	51
Age	VI		28
Relation to—			
Secondhand purchase and rebuilding		2	32
Idleness		9	37
Idleness, new machines		10	38
Style, new machines		2	32
Diameter, new machines		16	43
Needles per inch, new machines		17	44
Feeds, new machines		18	45
Rating		25	52
Style	VII		28
Relation to—			
Secondhand purchase and rebuilding		3	33
Idleness		1	32
Age		2	32
Diameter		19	46
Needles per inch		5	35
Feeds		6	36
Striper changes		7	36
Types of stitch and needle		3	33
Diameter	VIII		28
Relation to—			
Secondhand purchase and rebuilding		4	33
Idleness		11	39
Diameter—Continued.			
Relation to—			
Age (new machines only)		16	43
Style		19	46
Needles per inch		20	47
Feeds		21	48
Types of stitch and needle		19	46
Products		22	49
Rating		26	53
Needles per inch	IX		29
Relation to—			
Secondhand purchase and rebuilding		5	35
Idleness		12	40
Age (new machines only)		17	44
Style		5	35
Diameter		20	47
Rating		27	54
Feeds	X		29
Relation to—			
Secondhand purchase and rebuilding		6	36
Idleness		13	41
Age (new machines only)		18	45
Style		6	36
Diameter		21	48
Rating		28	54
Striper changes	XI		29
Relation to—			
Secondhand purchase and rebuilding		7	36
Style		7	36
Types of stitch and needle	XII XIII		30
Relation to—			
Secondhand purchase		8	37
Style		3	33
Diameter		19	46
Raw materials	XV		30
Relation to—			
Idleness		14	42
Products	XVI		31
Relation to—			
Idleness		15	42
Diameter		22	49
Rating	XVII		31
Relation to—			
Secondhand purchase and rebuilding		23	50
Idleness		24	51
Age		25	52
Diameter		26	53
Needles per inch		27	54
Feeds		28	54

FLAT MACHINES

Subject	Table No.		Page
	Summary	Detail	
Make	I		26
Secondhand purchase and rebuilding	II–IV		27
Relation to—			
Idleness		1a	32
Age		2a	33
Style		3a	33
Width		4a	34
Needles per inch		5a	35
Yarn changes		7a	36
Automatic or hand		8b	37
Rating		23a	51
Idleness	V		27
Relation to—			
Secondhand purchase and rebuilding		1a	32
Age		9a	33
Idleness—Continued.			
Relation to—			
Age, new machines only		10a	38
Style		1a	32
Width		11a	39
Needles per inch		12a	41
Yarn changes		13a	41
Raw materials		14a	42
Products		15a	43
Rating		24a	51
Age	VI		28
Relation to—			
Secondhand purchase and rebuilding		2a	33
Idleness		9a	38
Idleness, new machines		10a	38
Style, new machines		2a	33

INDEX TO TABLES—Continued

FLAT MACHINES—Continued

Subject	Table No. Summary	Table No. Detail	Page
Age—Continued.			
Relation to—			
Width, new machines	------	16a	44
Needles per inch, new machines	------	17a	45
Rating	------	25a	52
Style	VII	------	28
Relation to—			
Secondhand purchase and rebuilding	------	3a	33
Idleness	------	1a	32
Age	------	2a	33
Width	------	19a	46
Needles per inch	------	5a	35
Yarn changes	------	7a	36
Automatic or hand	------	3a	33
Width	VIII	------	28
Relation to—			
Secondhand purchase and rebuilding	------	4a	34
Idleness	------	11a	39
Age, new machines only	------	16a	44
Style	------	19a	46
Needles per inch	------	20a	47
Automatic or hand	------	19a	46
Products	------	22a	49
Rating	------	26a	53
Needles per inch	IX	------	29
Relation to—			
Secondhand purchase and rebuilding	------	5a	35
Idleness	------	12a	41
Age, new machines only	------	17a	45
Needles per inch—Continued.			
Relation to—			
Style	------	5a	35
Width	------	20a	47
Rating	------	27a	54
Yarn changes	XI	------	29
Relation to—			
Secondhand purchase and rebuilding	------	7a	36
Idleness	------	13a	41
Style	------	7a	36
Rating	------	28a	55
Automatic or hand operated	XIV	------	30
Relation to—			
Secondhand purchase	------	8a	37
Rebuilding	------	8aa	37
Style	------	3a	33
Width	------	19a	46
Raw materials	XV	------	30
Relation to—			
Idleness	------	14a	42
Products	XVI	------	31
Relation to—			
Idleness	------	15a	43
Width	------	22a	49
Rating	XVII	------	31
Relation to—			
Secondhand purchase and rebuilding	------	23a	51
Idleness	------	24a	51
Age	------	25a	52
Width	------	26a	53
Needles per inch	------	27a	54
Yarn changes	------	28a	55

SUMMARY TABLES I TO XVII

TABLE I

Circular machines: Make	Number	Per cent	Flat machines: Make	Number	Per cent
A	3	(1)	A	3	1
B	9	1	B	2	1
C	111	10	C	2	1
D	2	(1)	D	18	5
E	12	1	E	24	7
F	73	6	F	202	56
G	3	(1)	G	1	(1)
H	58	5	H	69	19
I	241	21	I [2]	14	4
J	19	2	J	12	3
K	10	1	K	5	1
L	1	(1)	L	3	1
M	206	18	M	4	1
N	380	34			
Total	1,128	100	Total	359	100
Unknown	25	----	Unknown	92	----
Grand total	1,153	----	Grand total	451	----

[1] Less than one-half of 1 per cent.

[2] These machines are of a separate type (Raschel), rather than make.

SUMMARY TABLES I TO XVII—Continued

TABLE II

Bought	Circular machines		Flat machines	
	Number	Per cent	Number	Per cent
New	641	69	168	54
Secondhand	284	31	141	46
Total	925	100	309	100
Unknown	228	----	142	----
Grand total	1,153	----	451	----

TABLE III

Rebuilt	Circular machines		Flat machines	
	Number	Per cent	Number	Per cent
Yes	201	21	54	18
No	744	79	250	82
Total	945	100	304	100
Unknown	208	----	147	----
Grand total	1,153	----	451	----

TABLE IV

Classification	Circular machines		Flat machines	
	Number	Per cent	Number	Per cent
Bought new:				
Rebuilt	58	7	19	7
Not rebuilt	506	63	127	45
Bought secondhand:				
Rebuilt	89	11	21	7
Not rebuilt	152	19	117	41
Total	805	100	284	100
Unknown	348	----	167	----
Grand total	1,153	----	451	----

TABLE V

Per cent of time in use, July to December, 1928	Circular machines		Flat machines	
	Number	Per cent	Number	Per cent
0	49	6	13	4
5	3	(1)	2	1
10	8	1	3	1
20	5	1	----	----
25	41	5	19	7
33⅓	----	----	2	1
40	3	(2)	----	----
50	307	38	75	27
60	----	----	5	2
75	92	11	54	19
80	65	8	8	3
90	4	(1)	12	4
95	2	(1)	13	4
100	217	27	66	23
125	9	1	----	----
150	----	----	13	4
Total	805	100	285	100
Unknown	348	----	166	----
Grand total	1,153	----	451	----

[1] Less than one-half of 1 per cent.

SUMMARY TABLES I TO XVII—Continued

TABLE VI

Number of years in present plant	Circular machines		Flat machines	
	Number	Per cent	Number	Per cent
Less than 1	88	10	26	10
1–3	187	22	77	29
4–7	300	36	73	28
8–12	218	26	49	18
13–20	54	6	29	11
35			2	(1)
50			10	4
Total	847	100	266	100
Unknown	306		185	
Grand total	1,153		451	

[1] Less than one-half of 1 per cent.

TABLE VII

Style	Circular machines		Flat machines	
	Number	Per cent	Number	Per cent
Plain	817	76	285	88
Pattern wheel	178	16		
Jacquard	84	8	40	12
Total	1,079	100	325	100
Unknown	74		126	
Grand total	1,153		451	

TABLE VIII

Circular machines			Flat machines		
Diameter in inches	Number	Per cent	Width in inches	Number	Per cent
Up to 1	21	2	2 to 5	3	1
1½ to 2	47	4	9	2	1
2⅛ to 3	98	9	10	19	6
3¼ to 4	52	5	11	1	(1)
4¼ to 5	56	5	12	20	6
5¼ to 6	22	2	14	6	2
6¼ to 7	10	1	16	23	7
7¼ to 8	10	1	18	32	9
8¼ to 9	14	1	20	38	11
9¼ to 10	31	3	21	1	(1)
10¼ to 11	16	1	22	20	6
11¼ to 12	42	4	23	1	(1)
13	27	2	24	27	8
14	62	6	25	2	1
15	38	3	26	18	5
16	96	9	27	1	(1)
17	37	3	28	9	3
18	86	8	30	4	1
19	58	5	31	2	1
20	68	6	32	43	13
21	47	4	33	1	(1)
22	30	3	34	6	2
23	16	1	36	12	4
24	13	1	37½	6	2
26	1	(1)	40	7	2
28	21	2	44	5	2
30	81	7	45	4	1
32	2	(1)	48	3	1
36	2	(1)	52	1	(1)
			80	3	1
			100	10	3
Total	1,104	100	Total	330	100
Unknown	49		Unknown	121	
Grand total	1,153		Grand total	451	

[1] Less than one-half of 1 per cent.

SUMMARY TABLES I TO XVII—Continued

TABLE IX

Circular machines			Flat machines		
Needles per inch	Number	Per cent	Needles per inch	Number	Per cent
2.5 to 2.9	63	6	2½	134	40
3 to 3.7	26	3	3	31	9
5.1 to 5.7	20	2	4½	2	1
6 to 6.9	30	3	5	15	4
7 to 7.8	198	20	6	9	3
7 or 8	70	7	6 or 8	13	4
8 to 8.5	252	25	6½	1	(1)
9 to 9.3	43	5	7	52	15
10 to 10.7	113	12	8	29	9
11 to 11.5	9	1	10	23	7
12	90	9	12	14	4
13 to 15	24	3	14	1	(1)
16 to 18	37	4	18	9	3
Total	975	100	Total	333	100
Unknown	178		Unknown	118	
Grand total	1,153		Grand total	451	

[1] Less than one-half of 1 per cent.

TABLE X

Number of feeds	Circular machines		Number of feeds	Circular machines	
	Number	Per cent		Number	Per cent
1	68	6	8 or 12	49	5
1 or 2	24	2	10	1	(1)
2	335	31	12	8	1
3	5	(1)	20	2	(1)
4	127	12	Total	1,069	100
4 or 6	15	1	Unknown	84	
6	191	18	Grand total	1,153	
4 or 8	14	1			
6 or 8	24	2			
8	206	19			

[1] Less than one-half of 1 per cent.

TABLE XI

Circular machines			Flat machines		
Striper changes	Number	Per cent	Yarn changes	Number	Per cent
None	589	56	None	112	39
1	36	3	1	30	11
2	160	15	2	58	20
2 or 3	15	1	3	52	18
2 or 4	16	2	4	25	9
3	55	5	5	8	3
4	107	10			
5	12	1			
6	6	1			
8	49	5			
16	2	(1)			
Total	1,047	100	Total	285	100
Unknown	106		Unknown	166	
Grand total	1,153		Grand total	451	

[1] Less than one-half of 1 per cent.

SUMMARY TABLES I TO XVII—Continued

TABLES XII AND XIII

Stitch	Circular machines		Needle	Circular machines	
	Number	Per cent		Number	Per cent
Rib	683	69	Latch	999	92
Jersey	310	31	Spring	84	8
Total	993	100	Total	1,083	100
Unknown	160	----------	Unknown	70	----------
Grand total	1,153	----------	Grand total	1,153	----------

TABLE XIV

Operation	Flat machines	
	Number	Per cent
Full automatic	65	22
Semiautomatic	164	57
Hand	62	21
Total	291	100
Unknown	160	----------
Grand total	451	----------

TABLE XV

Circular machines			Flat machines		
Raw materials	Number	Per cent	Raw materials	Number	Per cent
Wool	37	3	Worsted	56	19
Worsted	549	51	Wool, worsted	38	13
Wool, worsted	38	3	Wool, cotton	10	3
Wool, cotton	96	9	Worsted, cotton	11	4
Cotton, worsted	236	22	Merino, worsted	75	26
Merino, worsted	29	3	Worsted, alpaca	35	12
Worsted, zephyr	18	2	Merino, wool, worsted	30	10
Worsted, zephyr, artificial silk	17	2	Worsted, zephyr	19	7
Worsted, alpaca	17	2	Zephyr	13	5
Worsted, artificial silk	12	1	Worsted, artificial silk	2	1
Wool, worsted, merino	17	2			
Zephyr	4	(1)			
Wool, worsted, cotton	2	(1)			
Total	1,072	100	Total	289	100
Unknown	81	----------	Unknown	162	----------
Grand total	1,153	----------	Grand total	451	----------

[1] Less than one-half of 1 per cent.

SUMMARY TABLES I TO XVII—Continued

TABLE XVI

Circular machines			Flat machines		
Products	Number	Per cent	Products	Number	Per cent
Bathing suits	49	4	Trimmings	89	26
Bathing suits, trimmings	6	1	Shaker sweaters	120	35
Boys' suits, sport coats	8	1	Shaker sweaters, trimmings	16	5
Cloth	80	7	Sweaters, womens suits	2	1
Golf hose	1	(1)	Sweaters, hose	14	4
Women's wear	2	(1)	Sweaters	63	18
Men's scarfs	4	(1)	Sweaters, trimmings	14	4
Ribbed children's wear	12	1	Sweaters, bathing suits	10	3
Shaker sweaters	34	3	Sport coats	1	(1)
Sport coats, sweaters	8	1	Women's wear	13	4
Sport coats, sweaters, bathing suits	10	1			
Sweaters	279	26			
Sweaters, bathing suits	262	24			
Sweaters, cloth	2	(1)			
Sweaters, hose	58	5			
Sweaters, women's suits	12	1			
Trimmings	253	24			
Total	1,080	100	Total	342	100
Unknown	73	----------	Unknown	109	----------
Grand total	1,153	----------	Grand total	451	----------

[1] Less than one-half of 1 per cent.

TABLE XVII

Rating	Circular machines		Flat machines	
	Number	Per cent	Number	Per cent
0 per cent	27	2	59	14
5 per cent	233	20	263	61
7½ per cent	72	6	----------	----------
10 per cent	105	9	4	1
15 per cent	101	9	51	12
20 per cent	371	33	44	10
25 per cent	99	9	1	(1)
30 per cent	27	2	2	(1)
35 per cent	24	2	2	(1)
40 per cent	12	1	5	1
50 per cent	3	(1)	----------	----------
65 per cent	47	4	----------	----------
75 per cent	26	2	----------	----------
Total	1,147	100	431	100
Unknown	6	----------	20	----------
Grand total	1,153	----------	451	----------

[1] Less than one-half of 1 per cent.

DETAILED TABLES

Table 1.—Circular Machines Which Operated Varying Percentages of Normal Working Time, July to December, 1928, Classified According to Whether Bought New or Secondhand, Whether or Not Rebuilt, and Style

Per cent of time operated	Total	Bought new			Bought secondhand			Style		
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total	Plain	Pattern wheel	Jacquard
0	49	--------	6	7	5	1	16	37	1	--------
5	3	--------	1	1	--------	2	2	3	--------	--------
10	8	--------	8	8	--------	--------	--------	5	3	--------
20	5	--------	--------	--------	--------	--------	--------	--------	5	--------
25	41	--------	23	23	10	4	14	38	3	--------
40	3	--------	3	3	--------	--------	--------	3	--------	--------
50	307	11	142	208	7	46	53	265	31	10
75	92	--------	39	39	6	22	28	78	6	4
80	65	1	58	59	1	4	5	65	--------	--------
90	4	--------	3	3	--------	1	1	4	--------	--------
95	2	--------	2	2	--------	--------	--------	2	--------	--------
100	217	24	109	140	35	21	57	93	77	47
125	9	--------	9	9	--------	--------	--------	--------	--------	9
Unknown	348	22	103	139	25	51	108	224	52	14
Total	1,153	58	506	641	89	152	284	817	178	84

Table 1a.—Flat Machines Which Operated Varying Percentages of Normal Working Time, July to December, 1928, Classified According to Whether Bought New or Secondhand, Whether or Not Rebuilt, and Style

Per cent of time operated	Total	Bought new			Bought secondhand			Style	
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total	Plain	Jacquard
0	13	--------	2	3	2	8	10	13	--------
5	2	--------	--------	--------	2	--------	2	2	--------
10	3	2	1	3	--------	--------	--------	3	--------
25	19	1	13	14	--------	4	4	16	3
33⅓	2	--------	--------	--------	--------	2	2	2	--------
50	75	11	25	52	1	8	11	61	13
60	5	--------	--------	--------	--------	5	5	4	1
75	54	--------	23	23	1	24	25	41	8
80	8	5	3	8	--------	--------	--------	8	--------
90	12	--------	11	11	--------	1	1	12	--------
95	13	--------	13	13	--------	--------	--------	13	--------
100	66	--------	23	23	2	38	41	60	6
150	13	--------	3	3	--------	10	10	13	--------
Unknown	166	--------	10	15	13	17	30	37	9
Total	451	19	127	168	21	117	141	285	40

Table 2.—Circular Machines of Varying Periods of Use in Present Plant, Classified According to Whether Bought New or Secondhand, Whether or Not Rebuilt, and Style

Number of years in present plant	Total	Bought new			Bought secondhand			Style		
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total	Plain	Pattern wheel	Jacquard
Less than 1	88	--------	42	45	--------	42	43	71	2	14
1 to 3	187	4	132	143	6	36	44	116	11	56
4 to 7	300	34	190	227	32	21	53	231	68	--------
8 to 12	218	9	129	138	8	18	47	203	6	9
13 to 20	54	8	--------	38	2	6	8	54	--------	--------
Unknown	[1] 306	3	13	50	41	29	89	142	91	5
Total	1,153	58	506	641	89	152	284	817	178	84

[1] Includes 18 machines in present plant for varying lengths of time up to 20 years.

DETAILED TABLES—Continued

Table 2a.—Flat Machines of Varying Periods of Use in Present Plant, Classified According to Whether Bought New or Secondhand, Whether or Not Rebuilt, and Style

Number of years in present plant	Total	Bought new			Bought secondhand			Style	
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total	Plain	Jacquard
Less than 1	26	2	5	7	--------	19	19	13	13
1 to 3	77	--------	18	18	2	55	59	73	4
4 to 7	73	14	23	53	3	13	16	72	1
8 to 12	49	--------	31	31	--------	18	18	47	1
13 to 20	29	3	20	23	3	3	6	26	3
35	2	--------	--------	--------	--------	2	2	--------	2
50	10	--------	--------	--------	10	--------	10	10	--------
Unknown	185	--------	30	36	3	7	11	44	16
Total	451	19	127	168	21	117	141	285	40

Table 3.—Different Styles of Circular Machines, Variously Classified

Style	Total	Bought new			Bought secondhand			Stitch		Needle	
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total	Rib	Jersey	Latch	Spring
Plain	817	22	411	501	23	134	199	474	290	732	84
Pattern wheel	178	26	25	59	66	14	80	124	19	178	--------
Jacquard	84	10	69	79	--------	--------	--------	80	--------	84	--------
Unknown	74	--------	1	2	--------	4	5	5	1	5	--------
Total	1,153	58	506	641	89	152	284	683	310	999	84

Table 3a.—Different Styles of Flat Machines Classified According to Whether Bought New or Secondhand, Whether or Not Rebuilt, and Type of Operation

Style	Total	Bought new			Bought secondhand			Operation		
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total	Full automatic	Semiautomatic	Hand
Plain	285	18	113	148	19	102	124	39	163	52
Jacquard	40	1	8	9	2	15	17	26	--------	9
Unknown	126	--------	6	11	--------	--------	--------	--------	1	1
Total	451	19	127	168	21	117	141	65	164	62

Table 4.—Circular Machines of Different Diameters, Classified According to Whether Bought New or Secondhand and Whether or not Rebuilt

Diameter in inches	Total	Bought new			Bought secondhand		
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total
Up to 1	21	1	10	13	1	1	4
1½ to 2	47	--------	35	35	2	7	9
2⅛ to 3	98	3	43	61	4	19	25
3¼ to 4	52	3	27	35	2	15	17
4¼ to 5	56	--------	33	37	2	9	15
5¼ to 6	22	--------	15	15	--------	2	2
6¼ to 7	10	--------	8	8	--------	--------	2
7¼ to 8	10	--------	3	3	--------	1	3
8¼ to 9	14	--------	3	3	1	--------	5
9¼ to 10	31	1	10	11	5	--------	6

DETAILED TABLES—Continued

TABLE 4.—CIRCULAR MACHINES OF DIFFERENT DIAMETERS, CLASSIFIED ACCORDING TO WHETHER BOUGHT NEW OR SECONDHAND AND WHETHER OR NOT REBUILT—Continued.

Diameter in inches	Total	Bought new			Bought secondhand		
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total
10¼ to 11	16		5	5	5		5
11¼ to 12	42	2	10	14	12	6	18
13	27	3	8	11	8	4	13
14	62	11	22	35	3	8	13
15	38	2	16	19	6	3	10
16	96	15	53	82	4	2	7
17	37	2	19	22	5	2	7
18	86	5	35	55	12	6	19
19	58	5	23	31	5	9	14
20	68	2	39	50	5	5	10
21	47	2	21	25	4	7	11
22	30	1	16	18	1	5	6
23	16		9	10	1	1	2
24	13		6	6		4	4
26	1		1	1			
28	21		12	12		2	2
30	81		22	22	1	32	53
32	2		1	1			
36	2					2	2
Unknown	49		1	1			
Total	1,153	58	506	641	89	152	284

TABLE 4A.—FLAT MACHINES OF DIFFERENT WIDTHS, CLASSIFIED ACCORDING TO WHETHER BOUGHT NEW OR SECONDHAND AND WHETHER OR NOT REBUILT

Width in inches	Total	Bought new			Bought secondhand		
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total
2 to 5	3					1	1
9	2						
10	19		1	1	2	16	18
11	1		1	1			
12	20	1	17	18	2		2
14	6		2	2	1	2	3
16	23		17	17		4	4
18	32	1	10	16	1	12	13
20	38		6	12	2	22	25
21	1		1	1			
22	20		5	8		7	7
23	1						
24	27	1	6	8	1	10	12
25	2		1	1		1	1
26	18	1	9	11		7	7
27	1		1	1			
28	9		2	3		3	3
30	4		2	2		2	2
31	2		2	2			
32	43	1	18	23	2	12	14
33	1						1
34	6	3	3	5		1	1
36	12	1	6	7		4	4
37½	6		5	5			
40	7		1	1		6	6
44	5					5	5
45	4	1	3	4			
48	3		2	2		1	1
52	1		1	1			
80	3		3	3			
100	10				10		10
Unknown	121	9	3	13		1	1
Total	451	19	128	168	21	117	141

DETAILED TABLES—Continued

TABLE 5.—CIRCULAR MACHINES WITH VARYING NUMBER OF NEEDLES PER INCH, CLASSIFIED ACCORDING TO WHETHER BOUGHT NEW OR SECONDHAND, WHETHER OR NOT REBUILT, AND STYLE

Number of needles per inch	Total	Bought new			Bought secondhand			Style		
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total	Plain	Pattern wheel	Jacquard
2.5 to 2.9	63	1	55	56	1	5	6	50	12	
3 to 3.7	26	8	6	16		7	10	26		
5.1 to 5.7	20		6	11			1	17		3
6 to 6.9	30		10	10		13	14	21	9	
7 to 7.8	198	11	72	91	47	12	60	82	90	26
7 or 8	70	9	32	47		17	23	53		17
8 to 8.5	252	3	139	175	4	30	34	228	15	5
9 to 9.3	43		31	33	8	2	10	26	4	13
10 to 10.7	113		64	67	4	10	14	102	1	10
11 to 11.5	9	1	4	5		4	4	6	2	1
12	90	9	53	62	2	6	8	86	4	
13 to 15	24		4	4		16	16	22	2	
16 to 18	37	1	8	9		28	28	36	1	
Unknown	178	15	22	55	23	2	56	62	38	9
Total	1,153	58	506	641	89	152	284	817	178	84

TABLE 5A.—FLAT MACHINES WITH VARYING NUMBER OF NEEDLES PER INCH, CLASSIFIED ACCORDING TO WHETHER BOUGHT NEW OR SECONDHAND, WHETHER OR NOT REBUILT, AND STYLE

Number of needles per inch	Total	Bought new			Bought secondhand			Style	
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total	Plain	Jacquard
2½	134	17	77	94		30	30	123	6
3	31		18	28	1	2	3	31	
4½	2		1	1		1	1	2	
5	15		4	5		9	9	12	1
6	9		2	2		6	6	8	1
6 or 8	13					13	13	13	
6½	1					1	1	1	
7	52	2	12	19	4	13	17	39	13
8	29		8	8	6	14	20	22	6
10	23		5	6	10	6	17	18	5
12	14					13	14	14	
14	1						1	1	
18	9					9	9	1	8
Unknown	118			5					
Total	451	19	127	168	21	117	141	285	40

DETAILED TABLES—Continued

TABLE 6.—CIRCULAR MACHINES WITH VARYING NUMBER OF FEEDS, CLASSIFIED ACCORDING TO WHETHER BOUGHT NEW OR SECONDHAND, WHETHER OR NOT REBUILT, AND STYLE

Number of feeds	Total	Bought new			Bought secondhand			Style		
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total	Plain	Pattern wheel	Jacquard
1	68	1	49	52	2	10	13	68	-------	-------
1 or 2	24	-------	7	24	-------	-------	-------	24	-------	-------
2	335	38	136	189	15	44	71	244	87	-------
3	3	-------	2	2	-------	1	1	3	-------	-------
4	129	9	79	88	39	1	40	33	47	48
4 or 6	4	-------	-------	-------	-------	4	4	4	-------	-------
6	202	-------	77	107	3	53	76	186	6	10
4 or 8	14	-------	-------	-------	-------	14	14	14	-------	-------
6 or 8	24	-------	-------	-------	7	-------	7	24	-------	-------
8	206	10	120	139	-------	18	24	173	7	26
8 or 12	49	-------	26	26	23	-------	23	26	23	-------
10	1	-------	-------	-------	-------	-------	-------	1	-------	-------
12	8	-------	-------	3	-------	3	3	8	-------	-------
20	2	-------	2	2	-------	-------	-------	-------	2	-------
Unknown	84	-------	8	9	-------	4	8	9	6	-------
Total	1,153	58	506	641	89	152	284	817	178	84

TABLE 7.—CIRCULAR MACHINES WITH VARYING NUMBER OF STRIPER CHANGES, CLASSIFIED ACCORDING TO WHETHER BOUGHT NEW OR SECONDHAND, WHETHER OR NOT REBUILT, AND STYLE

Number of striper changes	Total	Bought new			Bought secondhand			Style		
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total	Plain	Pattern wheel	Jacquard
None	589	14	286	328	43	123	190	550	33	6
1	36	-------	16	18	-------	7	18	36	-------	-------
2	160	9	17	64	41	4	45	51	97	8
2 or 3	15	15	-------	15	-------	-------	-------	-------	15	-------
2 or 4	16	-------	16	16	-------	-------	-------	16	-------	-------
3	55	11	31	43	-------	6	12	39	7	9
4	107	9	59	68	-------	6	6	60	18	28
5	12	-------	12	12	-------	-------	-------	12	-------	-------
6	6	-------	6	6	-------	-------	-------	-------	-------	6
8	49	-------	41	41	-------	2	2	22	-------	27
16	2	-------	2	2	-------	-------	-------	-------	2	-------
Unknown	106	-------	20	28	5	4	11	31	6	-------
Total	1,153	58	506	641	89	152	284	817	178	84

TABLE 7A.—FLAT MACHINES WITH VARYING NUMBER OF YARN CHANGES, CLASSIFIED ACCORDING TO WHETHER BOUGHT NEW OR SECONDHAND, WHETHER OR NOT REBUILT, AND STYLE

Number of yarn changes	Total	Bought new			Bought second hand			Style	
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total	Plain	Jacquard
None	112	7	45	52	4	54	59	112	-------
1	30	-------	9	25	1	3	4	30	-------
2	58	1	29	30	1	16	17	52	6
3	52	2	17	19	5	14	20	35	17
4	25	-------	1	1	-------	23	23	15	10
5	8	-------	6	6	-------	2	2	1	7
Unknown	166	9	20	35	10	5	16	40	-------
Total	451	19	127	168	21	117	141	285	40

DETAILED TABLES—Continued

TABLE 8.—CIRCULAR MACHINES BOUGHT NEW AND SECONDHAND, CLASSIFIED BY NATURE OF STITCH AND NEEDLE

Bought	Total	Stitch		Needle	
		Rib	Jersey	Latch	Spring
New	641	417	212	620	20
Secondhand	284	141	62	218	64
Unknown	228	125	36	161	-------
Total	1,153	683	310	999	84

TABLE 8A.—FLAT MACHINES BOUGHT NEW AND SECONDHAND, CLASSIFIED BY TYPE OF OPERATION

Bought	Total	Full automatic	Semiautomatic	Hand operated	Unknown
New	168	17	100	20	31
Secondhand	141	33	59	39	10
Unknown	142	15	5	3	119
Total	451	65	164	62	160

TABLE 8B.—FLAT MACHINES REBUILT AND NOT REBUILT, CLASSIFIED ACCORDING TO TYPE OF OPERATION

Rebuilt or not	Total	Full automatic	Semiautomatic	Hand-operated	Unknown
Rebuilt	54	16	25	-------	13
Not rebuilt	250	48	119	57	26
Unknown	147	1	20	5	121
Total	451	65	164	62	160

TABLE 9.—CIRCULAR MACHINES WHICH OPERATED VARYING PERCENTAGES OF NORMAL WORKING TIME, JULY TO DECEMBER, 1928, CLASSIFIED ACCORDING TO LENGTH OF TIME IN PRESENT PLANT

Per cent of time in use	Total	Number of years in present plant					
		Less than 1	1–3	4–7	8–12	13–20	Unknown
0	49	1	2	5	19	2	20
5	3	-------	-------	3	-------	-------	-------
10	8	1	-------	-------	4	-------	3
20	5	-------	-------	-------	-------	-------	5
25	41	3	18	13	-------	-------	7
40	3	-------	3	-------	-------	-------	-------
50	307	34	35	66	69	39	64
75	92	4	44	18	17	8	1
80	65	16	1	34	12	-------	2
90	4	2	-------	2	-------	-------	-------
95	2	-------	-------	-------	2	-------	-------
100	217	23	60	49	21	5	59
125	9	-------	9	-------	-------	-------	-------
Unknown	348	4	15	110	74	-------	145
Total	1,153	88	187	300	218	54	306

DETAILED TABLES—Continued

TABLE 9A.—FLAT MACHINES WHICH OPERATED VARYING PERCENTAGES OF NORMAL WORKING TIME, JULY TO DECEMBER, 1928, CLASSIFIED ACCORDING TO LENGTH OF TIME IN PRESENT PLANT

Per cent of time operated	Total	Number of years in present plant							
		Less than 1	1-3	4-7	8-12	13-20	35	50	Unknown
0	13		4	1	5	2			1
5	2			2					
10	3					3			
25	19		4			14			1
33⅓	2		2						
50	75	2	6	36	9	3			19
60	5		5						
75	54	9	17	4					24
80	8			8					
90	12		1	11					
95	13				13				
100	66	15	19	6	17				9
150	13		11	2					
Unknown	166		8	3	5	7	2	10	131
Total	451	26	77	73	49	29	2	10	185

TABLE 10.—NEW CIRCULAR MACHINES WHICH OPERATED VARYING PERCENTAGES OF NORMAL WORKING TIME, JULY TO DECEMBER, 1928, CLASSIFIED ACCORDING TO LENGTH OF TIME IN PRESENT PLANT

Per cent of time operated	Total	Number of years in present plant					
		Less than 1	1-3	4-7	8-12	13-20	Unknown
0	7	1	1	1	4		
5	1			1			
10	8	1			4		3
25	23	3	17	3			
40	3		3				
50	208	1	28	61	53	38	27
75	39	4	22	1	11		1
80	59	16	1	29	12		1
90	3	2		1			
95	2				2		
100	140	15	57	47	18		3
125	9		9				
Unknown	139	2	5	83	34		15
Total	641	45	143	227	138	38	50

TABLE 10A.—NEW FLAT MACHINES WHICH OPERATED VARYING PERCENTAGES OF NORMAL WORKING TIME, JULY TO DECEMBER, 1928, CLASSIFIED ACCORDING TO LENGTH OF TIME IN PRESENT PLANT

Per cent of time in use	Total	Number of years in present plant					
		Less than 1	1-3	4-7	8-12	13-20	Unknown
0	3		1	1			1
10	3					3	
25	14					14	
50	52	2	4	30	9	1	6
75	23		3				20
80	8			8			
90	11			11			
95	13				13		
100	23	5	5	2	9		2
150	3		2	1			
Unknown	15		3			5	7
Total	168	7	18	53	31	23	36

DETAILED TABLES—Continued

TABLE 11.—CIRCULAR MACHINES OF DIFFERENT DIAMETERS, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME IN USE, JULY TO DECEMBER, 1928

Diameter in inches	Total	Per cent of time in use													
		0	5	10	20	25	40	50	75	80	90	95	100	125	Unknown
Up to 1	21	3				1		6		3			2		6
1⅛ to 2	47	4						12		6	2	1	5		17
2⅛ to 3	98	2		1		6		19	15	10			12		33
3¼ to 4	52	1	2			6	3	5	4		2		5		24
4¼ to 5	56	1				8		13	2	3			5		24
5¼ to 6	22	5						4	2	6			1		4
6¼ to 7	10	3						6							1
7¼ to 8	10	4	1					2	1				1		1
8¼ to 9	14	7						3	3						1
9¼ to 10	31	6			2			11	3				5		4
10¼ to 11	16	1			1	1		4	2	1			4		2
11¼ to 12	42	3						11	4	2			12		10
13	27	1				1		4	2				10		9
14	62	1		1	2	1		10	3	9			15		20
15	38			2		2		7	2	3			15		7
16	96					1		31	4	3			38	2	17
17	37					2		8	3	3			12		9
18	86	2		4		3		28	6	3			19		21
19	58					1		18	9	3			13		14
20	68	2				5		18	5	5			7		26
21	47					2		14	2	3			16		10
22	30							11	2	1			6		10
23	16					1		5	2	1			2		5
24	13							3	2				2		6
26	1												1		
28	21								7				6	7	1
30	81	1						52	6				2		20
32	2								1				1		
36	2							2							
Unknown	49	2										1			46
Total	1,153	49	3	8	5	41	3	307	92	65	4	2	217	9	348

TABLE 11A.—FLAT MACHINES OF DIFFERENT WIDTHS, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME IN USE, JULY TO DECEMBER, 1928

Width in inches	Total	Per cent of time in use													
		0	5	10	25	33⅓	50	60	75	80	90	95	100	150	Unknown
2 to 5	3				1								2		
9	2								1						1
10	19	2			2		1		13						1
11	1								1						
12	20		2		2		4		6	1	3		2		
14	6						2		1				1	2	
16	23				1		1		9		3		6		3
18	32	4		1	2		7		2	3		1	3	1	8
20	38	1		1	3	1	8		8				10		6
21	1												1		
22	20	1			1		6	1				3	3		5
23	1						1								
24	27	2		1	2		7	3	1		2		6	1	2
25	2								1						1
26	18					1	4	1	6	1			5		

DETAILED TABLES—Continued

TABLE 11A.—FLAT MACHINES OF DIFFERENT WIDTHS, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME IN USE, JULY TO DECEMBER, 1928—Continued

Width in inches	Total	Per cent of time in use													
		0	5	10	25	33⅓	50	60	75	80	90	95	100	150	Unknown
27	1								1						
28	9				1		4		1			1			2
30	4											1	2		1
31	2								2						
32	43	3			4		10				3	3	11		9
33	1						1								
34	6						1			2			2		1
36	12						1			1		1	5	2	2
37½	6												5		1
40	7						3						1	1	2
44	5										1		1	3	
45	4						4								
48	3													3	
52	1						1								
80	3														3
100	10														10
Unknown	121						9		1			3			108
Total	451	13	2	3	19	2	75	5	54	8	12	13	66	13	166

TABLE 12.—CIRCULAR MACHINES WITH DIFFERENT NUMBER OF NEEDLES PER INCH, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME IN USE, JULY TO DECEMBER, 1928

Number of needles per inch	Total	Per cent of time in use													
		0	5	10	20	25	40	50	75	80	90	95	100	125	Unknown
2.5 to 2.9	63							41	2	9		2	6		3
3 to 3.7	26					3			5				3		15
5.1 to 5.7	20								8				3		9
6 to 6.9	30		1	3				6					6		14
7 to 7.8	198	17	2	1	5	6		43	10	17	2		55	8	32
7 or 8	70									11			13		46
8 to 8.5	252	2		4		2		73	23	7			48		93
9 to 9.3	43	1				19		5	2				12	1	3
10 to 10.7	113					6		30	30	16			11		20
11 to 11.5	9					1		2					6		
12	90	5				3	3	48		5	2		24		
13 to 15	24	4				1		2	12				5		
16 to 18	37							37							
Unknown	178	20						20					25		113
Total	1,153	49	3	8	5	41	3	307	92	65	4	2	217	9	348

DETAILED TABLES—Continued

TABLE 12A.—FLAT MACHINES WITH DIFFERENT NUMBER OF NEEDLES PER INCH, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME IN USE, JULY TO DECEMBER, 1928

Number of needles per inch	Total	Per cent of time in use													
		0	5	10	25	33⅓	50	60	75	80	90	95	100	150	Unknown
2½	134	4			14		25		12	8	11	13	35		12
3	31						10		16				1		4
4½	2			1											1
5	15	5					5						1	2	2
6	9	1					1		1				1	4	1
6 or 8	13								13						
6½	1												1		
7	52	2	2	2	3	1	26	5	1				3	3	4
8	29				1		4		2		1		6	4	11
10	23	1					3						7		12
12	14				1	1	1						10		1
14	1												1		
18	9								9						
Unknown	118														118
Total	451	13	2	3	19	2	75	5	54	8	12	13	66	13	166

TABLE 13.—CIRCULAR MACHINES WITH DIFFERENT NUMBER OF FEEDS, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME IN USE, JULY TO DECEMBER, 1928

Number of feeds	Total	Per cent of time in use													
		0	5	10	20	25	40	50	75	80	90	95	100	125	Unknown
1	68	3				11	3	27	9				4		11
1 or 2	24							17		7					
2	335	30	2	4	5	14		58	32	14	4	2	60		110
3	3												3		
4	129	1	1			1		37	4	12			67	2	4
4 or 6	4									4					
6	202	1		4				110	19	1			21	7	39
4 or 8	14														14
6 or 8	24					7			17						
8	206	3				8		49	11	18			53		64
8 or 12	49									9					40
10	1														1
12	8												5		3
20	2												2		
Unknown	84	11						9					2		62
Total	1,153	49	3	8	5	41	3	307	92	65	4	2	217	9	348

TABLE 13A.—FLAT MACHINES WITH DIFFERENT NUMBER OF YARN CHANGES, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME IN USE, JULY TO DECEMBER, 1928

Number of yarn changes	Total	Per cent of time in use													
		0	5	10	25	33⅓	50	60	75	80	90	95	100	150	Unknown
None	112	6	2	2			11		28	8		8	34	4	9
1	30				2		18		3		5		1		1
2	58	2		1	16	2	6	5	6		4		2	3	11
3	52				1		26		3		1		8	6	7
4	25						2		9				13		1
5	8												6		2
Unknown	166	5					12		5		2	5	2		135
Total	451	13	2	3	19	2	75	5	54	8	12	13	66	13	166

DETAILED TABLES—Continued

TABLE 14.—CIRCULAR MACHINES USING DIFFERENT KINDS OF RAW MATERIALS, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME USED, JULY TO DECEMBER, 1928

Raw material	Total	Per cent of time in use													
		0	5	10	20	25	40	50	75	80	90	95	100	125	Unknown
Wool	37				5								1		31
Worsted	549	9	3	8		19		145	72	41	2		117		133
Wool, worsted	38						3	18		6	2				9
Wool, cotton	96	14								8					74
Cotton, worsted	236	10				14		124	8	10			50		20
Merino, worsted	29							18				2	8		1
Worsted, zephyr	18	4				2			2				10		
Worsted, zephyr, artificial silk	17												17		
Worsted, alpaca	17	1						2	4				1	9	
Worsted, artificial silk	12												12		
Wool, worsted, merino	17														17
Zephyr	4					3									1
Wool, worsted, cotton	2														2
Unknown	81	11				3			6				1		60
Total	1,153	49	3	8	5	41	3	307	92	65	4	2	217	9	348

TABLE 14A.—FLAT MACHINES USING DIFFERENT KINDS OF RAW MATERIAL, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME OPERATED, JULY TO DECEMBER, 1928

Raw material	Total	Per cent of time operated													
		0	5	10	25	33⅓	50	60	75	80	90	95	100	150	Unknown
Worsted	56	4		2			7		12		1		17		13
Wool, worsted	38	2			15		3		1	8			2	2	5
Wool, cotton	10						4								6
Worsted, cotton	11			1			6								4
Merino, worsted	75	1					31		1			13	29		
Worsted, alpaca	35				2		1	5	13				3	11	
Merino, wool, worsted	30	1							4		11		5		9
Worsted, zephyr	19				1	2	12						2		2
Zephyr	13				1								6		6
Worsted, artificial silk	2												2		
Unknown	162	5	2				11		23						121
Total	451	13	2	3	19	2	75	5	54	8	12	13	66	13	166

TABLE 15.—CIRCULAR MACHINES PRODUCING DIFFERENT PRODUCTS, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME OPERATED, JULY TO DECEMBER, 1928

Products	Total	Per cent of time in use													
		0	5	10	20	25	40	50	75	80	90	95	100	125	Unknown
Bathing suits	49					8		8	8				16		9
Bathing suits, trimmings	6								6						
Boys' suits, sport coats	8							2					6		
Cloth	80	10						50							20
Golf hose	1												1		
Women's wear	2												2		
Men's scarfs	4	4													
Ribbed children's wear	12							12							
Shaker sweaters	34							26		6		1			1
Sport coats, sweaters	8												7		1
Sport coats, sweaters, bathing suits	10														10
Sweaters	279	15		3		6		74	26	13			68	9	65
Sweaters, bathing suits	262	3		4				67	35	27			41		85
Sweaters, cloth	2							2							
Sweaters, hose	58				5	3		18					32		
Sweaters, women's suits	12												12		
Trimmings	253	11	3	1		24	3	48	17	19	4	1	31		91
Miscellaneous and unknown	73	6											1		66
Total	1,153	49	3	8	5	41	3	307	92	65	4	2	217	9	348

DETAILED TABLES—Continued

TABLE 15A.—FLAT MACHINES PRODUCING DIFFERENT PRODUCTS, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME OPERATED, JULY TO DECEMBER, 1928

Products	Total	Per cent of time operated													
		0	5	10	25	33⅓	50	60	75	80	90	95	100	150	Unknown
Trimmings	89	5	2	2	3	2	25		22	3			13	3	9
Shaker sweaters	120	3			14		17		21	3	11	13	29		9
Shaker sweaters, trimmings	16						16								
Sweaters, women's suits	2												2		
Sweaters, hose	14						12								2
Sweaters	63			1			5	5	2	2			12	8	28
Sweaters, trimmings	14										1		10	2	1
Sweaters, bathing suits	10														10
Sport coats	1														1
Women's wear	13								9						4
Unknown	109	5			2										102
Total	451	13	2	3	19	2	75	5	54	8	12	13	66	13	166

TABLE 16.—NEW CIRCULAR MACHINES OF DIFFERENT DIAMETERS, CLASSIFIED ACCORDING TO LENGTH OF TIME IN PRESENT PLANT

Diameter in inches	Total	Number of years in present plant					
		Less than 1	1–3	4–7	8–12	13–20	Unknown
Up to 1	13	3	3	3	3	1	
1⅛ to 2	35		1	21	9		4
2⅛ to 3	61	6	18	10	11		16
3¼ to 4	35	5	9	10	2		9
4¼ to 5	37	5	8	14	6		4
5¼ to 6	15			7	7		1
6¼ to 7	8			6	2		
7¼ to 8	3			2	1		
8¼ to 9	3			1	2		
9¼ to 10	11		1	7	3		
10¼ to 11	5			4	1		
11¼ to 12	14		1	9	1	3	
13	11		1	7	3		
14	35	1	1	12	17	3	1
15	19		4	9	4		2
16	82	2	37	23	6	5	9
17	22	1	5	10	6		
18	55	11	6	12	10	14	2
19	31	1	4	17	7	1	1
20	50	3	9	23	6	8	1
21	25	2	6	11	5	1	
22	18	1	7	5	3	2	
23	10	1	5	3	1		
24	6		5		1		
26	1		1				
28	12	1	10	1			
30	22	2			20		
32	1		1				
Unknown	1				1		
Total	641	45	143	227	138	38	50

DETAILED TABLES—Continued

TABLE 16A.—NEW FLAT MACHINES OF DIFFERENT WIDTHS, CLASSIFIED ACCORDING TO LENGTH OF TIME IN PRESENT PLANT

Width in inches	Total	Number of years in present plant					
		Less than 1	1-3	4-7	8-12	13-20	Unknown
10	1	----------	----------	1	----------	----------	1
11	1	----------	----------	----------	----------	----------	1
12	18	----------	2	4	4	2	6
14	2	----------	1	1	----------	----------	----------
16	17	----------	1	5	----------	2	9
18	16	----------	1	9	1	3	2
20	12	----------	1	3	1	4	3
21	1	----------	----------	----------	1	----------	----------
22	8	----------	----------	4	3	1	----------
24	8	----------	1	2	2	2	1
25	1	----------	----------	----------	----------	----------	1
26	11	----------	4	3	----------	----------	4
27	1	----------	----------	----------	----------	----------	1
28	3	----------	----------	1	1	1	----------
30	2	----------	1	----------	1	----------	----------
31	2	----------	1	----------	----------	----------	1
32	23	----------	1	8	7	4	3
34	5	1	2	2	----------	----------	----------
36	7	----------	----------	1	5	1	----------
37½	5	5	----------	----------	----------	----------	----------
40	1	----------	----------	----------	1	----------	----------
45	4	1	----------	----------	----------	----------	3
48	2	----------	2	----------	----------	----------	----------
52	1	----------	----------	----------	1	----------	----------
80	3	----------	----------	----------	----------	3	----------
Unknown	13	----------	----------	9	3	----------	1
Total	168	7	18	53	31	23	37

TABLE 17.—NEW CIRCULAR MACHINES WITH DIFFERENT NUMBER OF NEEDLES PER INCH, CLASSIFIED ACCORDING TO LENGTH OF TIME IN PRESENT PLANT

Number of needles per inch	Total	Number of years in present plant					
		Less than 1	1-3	4-7	8-12	13-20	Unknown
2.5 to 2.9	56	1	1	29	24	----------	1
3 to 3.7	16	----------	----------	10	5	----------	1
5.1 to 5.7	11	----------	5	----------	----------	----------	6
6 to 6.9	10	----------	----------	1	6	----------	3
7 to 7.8	91	7	28	39	5	----------	12
7 or 8	47	----------	13	16	18	----------	----------
8 to 8.5	175	----------	38	89	16	30	2
9 to 9.3	33	3	25	4	1	----------	----------
10 to 10.7	67	27	14	11	11	----------	4
11 to 11.5	5	----------	5	----------	----------	----------	----------
12	62	4	3	13	31	8	3
13 to 15	4	2	----------	1	1	----------	----------
16 to 18	9	----------	----------	1	8	----------	----------
Unknown	55	1	11	13	12	----------	18
Total	641	45	143	227	138	38	50

DETAILED TABLES—Continued

TABLE 17A.—NEW FLAT MACHINES WITH DIFFERENT NUMBER OF NEEDLES PER INCH, CLASSIFIED ACCORDING TO LENGTH OF TIME IN PRESENT PLANT

Number of needles per inch	Total	Number of years in present plant					
		Less than 1	1-3	4-7	8-12	13-20	Unknown
2½	94	2	13	29	23	14	13
3	28	----------	2	10	----------	1	15
4½	1	----------	----------	----------	----------	1	----------
5	5	----------	----------	1	4	----------	----------
6	2	----------	----------	2	----------	----------	----------
7	19	----------	2	10	4	3	----------
8	8	----------	1	1	----------	4	2
10	6	5	----------	----------	----------	----------	1
Unknown	5	----------	----------	----------	----------	----------	5
Total	168	7	18	53	31	23	36

TABLE 18.—NEW CIRCULAR MACHINES WITH DIFFERENT NUMBER OF FEEDS, CLASSIFIED ACCORDING TO LENGTH OF TIME IN PRESENT PLANT

Number of feeds	Total	Number of years in present plant					
		Less than 1	1-3	4-7	8-12	13-20	Unknown
1	52	4	13	5	26	1	3
1 or 2	24	7	----------	----------	----------	----------	17
2	189	6	27	102	30	----------	24
3	2	2	----------	----------	----------	----------	----------
4	88	14	34	25	8	7	----------
6	107	----------	22	10	45	30	----------
8	139	----------	44	62	29	----------	4
8 or 12	26	9	----------	17	----------	----------	----------
12	3	----------	2	----------	----------	----------	1
20	2	2	----------	----------	----------	----------	----------
Unknown	9	1	1	6	----------	----------	1
Total	641	45	143	227	138	38	50

TABLE 19.—CIRCULAR MACHINES OF DIFFERENT DIAMETERS, CLASSIFIED ACCORDING TO STYLE, TYPE OF STITCH, AND TYPE OF NEEDLE

Diameter in inches	Total	Style			Stitch		Needle	
		Plain	Pattern wheel	Jacquard	Rib	Jersey	Latch	Spring
Up to 1	21	17	----------	----------	5	12	17	----------
1⅛ to 2	47	38	7	----------	7	38	45	----------
2⅛ to 3	98	90	----------	----------	63	24	89	----------
3¼ to 4	52	52	----------	----------	32	20	52	----------
4¼ to 5	56	51	4	----------	41	13	55	----------
5¼ to 6	22	18	1	----------	6	12	19	----------
6¼ to 7	10	8	1	----------	2	6	10	----------
7¼ to 8	10	9	----------	----------	6	2	9	----------
8¼ to 9	14	12	2	----------	8	1	14	----------
9¼ to 10	31	19	12	----------	24	1	31	----------
10¼ to 11	16	8	8	----------	11	----------	16	----------
11¼ to 12	42	22	19	----------	28	5	42	----------
13	27	13	12	----------	16	4	26	----------
14	62	35	16	10	50	8	62	----------
15	38	20	17	1	27	7	38	----------

DETAILED TABLES—Continued

TABLE 19.—CIRCULAR MACHINES OF DIFFERENT DIAMETERS, CLASSIFIED ACCORDING TO STYLE, TYPE OF STITCH, AND TYPE OF NEEDLE—Con.

Diameter in inches	Total	Style			Stitch		Needle	
		Plain	Pattern wheel	Jacquard	Rib	Jersey	Latch	Spring
16	96	35	24	36	82	9	96	-
17	37	28	8	1	27	8	36	1
18	86	64	12	10	56	27	84	2
19	58	45	13	-	41	17	53	5
20	68	57	8	2	51	16	66	1
21	47	39	5	3	30	16	46	1
22	30	22	3	5	27	3	29	1
23	16	15	1	-	13	3	15	1
24	13	10	-	3	12	1	13	-
26	1	-	-	1	1	-	1	-
28	21	10	-	11	12	8	21	-
30	81	76	5	-	4	47	11	70
32	2	1	-	1	1	1	2	-
36	2	2	-	-	-	-	-	2
Unknown	49	1	-	-	-	1	1	-
Total	1,153	817	178	84	683	310	999	84

TABLE 19A.—FLAT MACHINES OF DIFFERENT WIDTHS, CLASSIFIED ACCORDING TO STYLE AND TYPE OF OPERATION

Width in inches	Total	Style		Operation		
		Plain	Jacquard	Full automatic	Semiautomatic	Hand
2 to 5	3	3	-	3	-	-
9	2	1	-	-	1	-
10	19	19	-	1	2	16
11	1	-	-	-	-	1
12	20	19	-	-	12	1
14	6	6	-	2	4	-
16	23	19	1	1	15	3
18	32	30	-	3	15	10
20	38	24	9	2	17	12
21	1	1	-	-	1	-
22	20	15	-	3	6	5
23	1	-	1	1	-	-
24	27	21	6	14	8	4
25	2	2	-	-	2	-
26	18	17	1	6	10	2
27	1	1	-	-	1	-
28	9	7	2	4	3	1
30	4	4	-	2	1	1
31	2	2	-	-	2	-
32	43	33	10	7	29	-
33	1	1	-	-	-	1
34	6	6	-	-	6	-
36	12	10	2	2	9	-
37½	6	1	5	5	1	-
40	7	4	3	5	1	1
44	5	5	-	1	3	1
45	4	4	-	-	4	-
48	3	3	-	2	1	-
52	1	1	-	1	-	-
80	3	3	-	-	-	-
100	10	10	-	-	-	-
Unknown	121	13	-	-	10	3
Total	451	285	40	65	164	62

DETAILED TABLES—Continued

TABLE 20.—CIRCULAR MACHINES OF DIFFERENT DIAMETERS, CLASSIFIED ACCORDING TO NUMBER OF NEEDLES PER INCH

Diameter in inches	Total	Number of needles per inch													
		2.5 to 2.9	3 to 3.7	5.1 to 5.7	6 to 6.9	7 to 7.8	7 or 8	8 to 8.5	9 to 9.3	10 to 10.7	11 to 11.5	12	13 to 15	16 to 18	Unknown
Up to 1	21	-	-	-	-	3	-	1	3	2	2	5	-	-	5
1⅛ to 2	47	4	-	-	-	14	-	5	1	1	-	15	-	-	7
2⅛ to 3	98	9	12	1	10	8	-	21	5	9	-	-	-	-	23
3¼ to 4	52	-	-	6	-	10	-	16	2	7	-	8	3	-	-
4¼ to 5	56	6	3	2	4	4	-	17	2	8	-	-	2	-	8
5¼ to 6	22	8	1	-	-	4	-	-	-	1	-	-	2	-	6
6¼ to 7	10	6	-	-	-	-	-	-	-	1	-	-	1	-	2
7¼ to 8	10	1	-	1	1	2	-	1	-	-	-	1	-	-	3
8¼ to 9	14	1	-	2	1	6	-	-	-	-	-	-	-	-	4
9¼ to 10	31	1	-	2	1	24	-	2	-	-	-	-	-	-	1
10¼ to 11	16	-	-	1	1	13	-	1	-	-	-	-	-	-	-
11¼ to 12	42	2	-	1	2	23	3	8	-	-	-	1	-	-	2
13	27	3	1	-	1	10	4	4	1	-	-	-	-	-	3
14	62	4	1	1	3	14	23	11	-	1	-	4	-	-	-
15	38	3	1	-	2	6	2	12	2	2	-	6	-	-	2
16	96	2	1	-	1	31	16	17	1	5	1	1	-	-	20
17	37	1	1	-	2	5	1	10	3	6	-	5	1	-	2
18	86	4	3	-	1	8	3	32	3	20	-	5	2	-	5
19	58	4	-	-	-	4	1	19	2	9	-	7	5	1	6
20	68	3	-	-	-	-	7	27	6	10	2	8	1	-	4
21	47	-	2	-	-	-	1	18	3	4	2	12	2	-	3
22	30	-	-	-	-	-	3	15	3	2	-	5	1	-	1
23	16	-	-	-	-	-	1	7	1	2	-	3	1	-	1
24	13	-	-	-	-	-	4	4	2	2	-	1	-	-	-
26	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-
28	21	-	-	3	-	7	1	1	1	6	2	-	-	-	-
30	81	-	-	-	-	-	-	3	-	14	-	3	3	36	22
32	2	-	-	-	-	-	-	-	1	1	-	-	-	-	-
36	2	-	-	-	-	2	-	-	-	-	-	-	-	-	-
Unknown	49	1	-	-	-	-	-	-	-	-	-	-	-	-	48
Total	1,153	63	26	20	30	198	70	252	43	113	9	90	24	37	178

TABLE 20A.—FLAT MACHINES OF DIFFERENT WIDTHS, CLASSIFIED ACCORDING TO NUMBER OF NEEDLES PER INCH

Width in inches	Total	Needles per inch													
		2½	3	4½	5	6	6 or 8	6½	7	8	10	12	14	18	Unknown
2 to 5	3	-	-	-	-	-	-	-	2	-	-	1	-	-	-
9	2	1	-	-	-	-	-	-	-	-	-	-	-	-	1
10	19	-	1	-	-	1	13	-	4	-	-	-	-	-	-
11	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
12	20	9	5	-	-	-	-	-	6	-	-	-	-	-	-
14	6	1	-	-	-	2	-	-	1	2	-	-	-	-	-
16	23	15	4	-	-	1	-	-	1	2	-	-	-	-	-
18	32	13	3	-	3	-	-	-	7	2	-	2	-	1	1
20	38	12	2	1	3	-	-	-	2	2	5	-	-	8	3
21	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
22	20	4	-	-	2	-	-	-	4	-	2	3	-	-	5
23	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-
24	27	5	1	-	2	-	-	-	11	4	1	2	1	-	-
25	2	-	1	1	-	-	-	-	-	-	-	-	-	-	-
26	18	4	6	-	1	-	-	-	1	2	-	4	-	-	-
27	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-
28	9	4	1	-	-	-	-	-	4	-	-	-	-	-	-
30	4	2	1	-	-	-	-	-	-	-	-	1	-	-	-
31	2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
32	43	32	4	-	1	1	-	-	3	2	-	-	-	-	-

DETAILED TABLES—Continued

TABLE 20A.—FLAT MACHINES OF DIFFERENT WIDTHS, CLASSIFIED ACCORDING TO NUMBER OF NEEDLES PER INCH—Continued

Width in inches	Total	Needles per inch													
		2½	3	4½	5	6	6 or 8	6½	7	8	10	12	14	18	Unknown
33	1											1			
34	6	6													
36	12	7			1				1	3					
37½	6								1		5				
40	7				1	2				4					
44	5					2		1		2					
45	4	4													
48	3								2	1					
52	1				1										
80	3									3					
100	10										10				
Unknown	121	12							1						108
Total	451	134	31	2	15	9	13	1	52	29	23	14	1	9	118

TABLE 21.—CIRCULAR MACHINES OF DIFFERENT DIAMETERS, CLASSIFIED ACCORDING TO NUMBER OF FEEDS

Diameter in inches	Total	Number of feeds														
		1	1 or 2	2	3	4	4 or 6	6	4 or 8	6 or 8	8	8 or 12	10	12	20	Unknown
Up to 1	21	11	1	4												5
1⅛ to 2	47	2		39		2										4
2⅛ to 3	98	12	17	54		4										11
3¼ to 4	52	14		31	3	1										3
4¼ to 5	56	12	6	32		1					1					4
5¼ to 6	22	4		9		4										5
6¼ to 7	10	1		6		2										1
7¼ to 8	10	1		7		1										1
8¼ to 9	14			14												
9¼ to 10	31			24		6		1								
10¼ to 11	16			11		4		1								
11¼ to 12	42			18		12		5	1		4	2				
13	27	1		8		8		2	2		4	1				1
14	62	2		17		7	2	3	5		26					
15	38	2		10		6	2	4			12	2				
16	96	1		24		41		8		1	18	3				
17	37	1		6	2		11			1	11	5				
18	86	2		8		18		26		1	23	7	1			
19	58	1		9		3		15		3	18	7		2		
20	68			2		3		12		3	35	10		2		1
21	47	1		1		2		16		1	18	6		2		
22	30					1		6	2		17	3		1		
23	16							6			6	3		1		
24	13							1	4	1	7					
26	1										1					
28	21					1		10		6	4					
30	81							73		6					2	
32	2									1	1					
36	2							2								
Unknown	49			1												48
Total	1,153	68	24	335	5	127	15	191	14	24	206	49	1	8	2	84

DETAILED TABLES—Continued

TABLE 22.—CIRCULAR MACHINES OF DIFFERENT DIAMETERS, CLASSIFIED ACCORDING TO PRODUCT

Diameter in inches	Total	Bathing suits	Bathing suits, trimmings	Boys' suits, sport coats	Cloth	Golf hose	Women's wear	Men's scarfs	Ribbed children's wear	Shaker sweaters	Sport coats, sweaters	Sport coats, sweaters, bathing suits	Sweaters	Sweaters, bathing suits	Sweaters, cloth	Sweaters, hose	Sweaters, women's suits	Trimmings	Miscellaneous and unknown
Up to 1	21	1												1				15	4
1⅛ to 2	47									3			2					42	
2⅛ to 3	98		4							1				4				76	13
3¼ to 4	52		2															50	
4¼ to 5	56					1		1		3			2	2				45	2
5¼ to 6	22							2		4			1					14	1
6¼ to 7	10				2			1		4			2						1
7¼ to 8	10				2					1			3					4	
8¼ to 9	14				4				1				9						
9¼ to 10	31				2				5				19	1		2		2	
10¼ to 11	16								3				11			1		1	
11¼ to 12	42	1							3				27	10				1	
13	27									2			18	5				1	1
14	62	1								2		9	18	23		9			
15	38	2		1						2	1		20	7		5			
16	96	3								1	1		36	20		26	9		
17	37	6		1						1	1		16	10		1		1	
18	86	3		2						4	1		29	34		11			2
19	58	6		1						3	1		22	24		1			
20	68	12		1						2			11	39		2			1
21	47	8		1							1		12	24				1	
22	30	3										1	5	21					
23	16	2									2		3	9					
24	13													13					
26	1													1					
28	21	1		1									10	6			3		
30	81				68		2						3	6	2				
32	2													2					
36	2				2														
Unknown	49									1									48
Total	1,153	49	6	8	80	1	2	4	12	34	8	10	279	262	2	58	12	253	73

TABLE 22A.—FLAT MACHINES OF DIFFERENT WIDTHS, CLASSIFIED ACCORDING TO PRODUCT

Width in inches	Total	Trimmings	Shaker sweaters	Shaker sweaters, trimmings	Sweaters, women's suits	Sweaters, hose	Sweaters	Sweaters, trimmings	Sweaters, bathing suits	Sport coats	Women's wear	Unknown
2 to 5	3	3										
9	2	1										1
10	19	17										2
11	1						1					
12	20	6	11				3					
14	1	5	1									
16	23	8	15									
18	32	13	6	4			1	2			1	5
20	38	10	9	3	2		1				8	5
21	1		1									
22	20	3	4	3			1	3				6
23	1					1						
24	27	7	6			6	5	1		1		1
25	2	1	1									
26	18	3	8	1			3	3				

DETAILED TABLES—Continued

TABLE 22A.—FLAT MACHINES OF DIFFERENT WIDTHS, CLASSIFIED ACCORDING TO PRODUCT—Continued

Width in inches	Total	Trimmings	Shaker sweaters	Shaker sweaters, trimmings	Sweaters, women's suits	Sweaters, hose	Sweaters	Sweaters, trimmings	Sweaters, bathing suits	Sport coats	Women's wear	Unknown
27	1	-	1	-	-	-	-	-	-	-	-	-
28	9	4	2	1	-	2	-	-	-	-	-	-
30	4	1	2	-	-	-	-	1	-	-	-	-
31	2	-	2	-	-	-	-	-	-	-	-	-
32	43	4	24	4	-	4	7	-	-	-	-	-
33	1	1	-	-	-	-	-	-	-	-	-	-
34	6	-	4	-	-	-	2	-	-	-	-	-
36	12	-	7	-	-	1	3	-	-	-	1	-
37½	6	-	-	-	-	-	5	1	-	-	-	-
40	7	1	-	-	-	-	6	-	-	-	-	-
44	5	-	-	-	-	-	4	1	-	-	-	-
45	4	-	4	-	-	-	-	-	-	-	-	-
48	3	-	-	-	-	-	1	2	-	-	-	-
52	1	-	-	-	-	-	1	-	-	-	-	-
80	3	-	-	-	-	-	-	-	-	-	3	-
100	10	-	-	-	-	-	-	-	10	-	-	-
Unknown	121	1	12	-	-	-	19	-	-	-	-	89
Total	451	89	120	16	2	14	63	14	10	1	13	109

TABLE 23.—CIRCULAR MACHINES WITH DIFFERENT RATINGS, CLASSIFIED ACCORDING TO WHETHER BOUGHT NEW OR SECONDHAND AND WHETHER OR NOT REBUILT

Rating (per cent)	Total number	Bought new			Bought secondhand		
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total
0	27	-	2	2	2	-	3
5	233	9	122	153	9	23	46
7½	72	-	20	20	-	32	52
10	105	8	30	38	-	38	38
15	101	-	32	61	14	13	27
20	371	16	167	200	34	40	82
25	99	9	34	43	30	6	36
30	27	15	4	27	-	-	-
35	24	-	8	8	-	-	-
40	12	-	12	12	-	-	-
50	3	-	3	3	-	-	-
65	47	1	46	47	-	-	-
75	26	-	26	26	-	-	-
Unknown	6	-	-	1	-	-	-
Total	1,153	58	506	641	89	152	292

DETAILED TABLES—Continued

TABLE 23A.—FLAT MACHINES OF DIFFERENT RATINGS, CLASSIFIED ACCORDING TO WHETHER BOUGHT NEW OR SECONDHAND AND WHETHER OR NOT REBUILT

Rating (per cent)	Total number	Bought new			Bought secondhand		
		Rebuilt	Not rebuilt	Total	Rebuilt	Not rebuilt	Total
0	59	-	-	-	-	-	-
5	263	17	101	140	16	59	76
10	4	-	1	1	-	3	3
15	51	-	11	11	4	19	24
20	44	2	7	9	1	34	35
25	1	-	-	-	-	-	1
30	2	-	-	-	-	2	2
35	2	-	2	2	-	-	-
40	5	-	5	5	-	-	-
Unknown	20	-	-	-	-	-	-
Total	451	19	127	168	21	117	141

TABLE 24.—CIRCULAR MACHINES WITH DIFFERENT RATINGS, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME IN USE, JULY TO DECEMBER, 1928

Rating (per cent)	Total number	Per cent of time in use													
		0	5	10	20	25	40	50	75	80	90	95	100	125	Unknown
0	27	5	-	-	-	-	-	-	1	-	-	-	1	-	20
5	233	19	1	1	-	12	-	76	8	24	2	-	17	-	73
7½	72	-	-	-	-	-	-	52	-	-	-	-	-	-	20
10	105	16	-	-	-	1	-	10	27	-	-	2	5	-	44
15	101	-	-	4	-	7	-	54	-	4	-	-	11	-	21
20	371	4	2	3	4	11	-	58	49	28	-	-	53	-	159
25	99	4	-	-	1	6	3	27	3	-	-	-	49	-	6
30	27	-	-	-	-	-	-	12	-	-	-	-	15	-	-
35	24	-	-	-	-	3	-	8	-	-	-	-	13	-	-
40	12	-	-	-	-	-	-	-	-	-	-	-	12	-	-
50	3	-	-	-	-	-	-	-	1	-	-	-	2	-	-
65	47	-	-	-	-	-	-	10	3	-	-	-	25	9	-
75	26	-	-	-	-	1	-	-	-	9	2	-	14	-	-
Unknown	6	1	-	-	-	-	-	-	-	-	-	-	-	-	5
Total	1,153	49	3	8	5	41	3	307	92	65	4	2	217	9	348

TABLE 24A.—FLAT MACHINES OF DIFFERENT RATINGS, CLASSIFIED ACCORDING TO PER CENT OF NORMAL WORKING TIME IN USE, JULY TO DECEMBER, 1928

Rating (per cent)	Total	Per cent of time in use													
		0	5	10	25	33⅓	50	60	75	80	90	95	100	150	Unknown
0	59	-	-	-	-	-	-	-	-	-	-	-	-	-	59
5	263	13	-	1	14	-	46	-	29	8	12	12	46	1	81
10	4	-	-	-	-	-	1	-	1	-	-	-	-	1	1
15	51	-	2	-	1	1	20	5	13	-	-	-	7	1	1
20	44	-	-	2	4	1	8	-	11	-	-	1	7	8	2
25	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
30	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
35	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-
40	5	-	-	-	-	-	-	-	-	-	-	-	5	-	-
Unknown	20	-	-	-	-	-	-	-	-	-	-	-	-	-	20
Total	451	13	2	3	19	2	75	5	54	8	12	13	66	13	166

DETAILED TABLES—Continued

TABLE 25.—CIRCULAR MACHINES WITH DIFFERENT RATINGS, CLASSIFIED ACCORDING TO LENGTH OF TIME IN PRESENT PLANT

Rating (per cent)	Total	Number of years in present plant					
		Less than 1	1–3	4–7	8–12	13–20	Unknown
0	27			1		2	24
5	233	6	29	73	48	6	71
7½	72	32			40		
10	105		22	15	36	16	16
15	101		6	28	18	29	20
20	371	19	47	147	63	1	94
25	99		15	19	13		52
30	27		2	17			8
35	24		8				16
40	12		12				
50	3	1	2				
65	47	3	44				
75	26	26					
Unknown	6	1					5
Total	1,153	88	187	300	218	54	306

TABLE 25A.—FLAT MACHINES OF DIFFERENT RATINGS, CLASSIFIED ACCORDING TO LENGTH OF TIME IN PRESENT PLANT

Rating (per cent)	Total	Number of years in present plant							
		Less than 1	1–3	4–7	8–12	13–20	35	50	Unknown
0	59								59
5	263	10	34	58	41	26	2	10	82
10	4		2	2					
15	51		20	7	4				20
20	44	11	18	4	4	3			4
25	1		1						
30	2			2					
35	2		2						
40	5	5							
Unknown	20								20
Total	451	26	77	73	49	29	2	10	185

TABLE 26.—CIRCULAR MACHINES OF DIFFERENT DIAMETERS, CLASSIFIED ACCORDING TO RATING

Diameter in inches	Total	Rating (per cent)													
		0	5	7½	10	15	20	25	30	35	40	50	65	75	Unknown
Up to 1	21	2	18		1										
1⅛ to 2	47	2	39		6										
2⅛ to 3	98		64		22	1	10	1							
3¼ to 4	52		11		12		18	6						5	
4¼ to 5	56	1	16			1	38								
5¼ to 6	22	1	14				7								
6¼ to 7	10		9			1									
7¼ to 8	10		6		4										
8¼ to 9	14		5		5	2	2								
9¼ to 10	31		2		9	6	9	5							

DETAILED TABLES—Continued

TABLE 26.—CIRCULAR MACHINES OF DIFFERENT DIAMETERS, CLASSIFIED ACCORDING TO RATING—Continued

Diameter in inches	Total	Rating (per cent)													
		0	5	7½	10	15	20	25	30	35	40	50	65	75	Unknown
10¼ to 11	16		1		3	4	4	4							
11¼ to 12	42		2		8	12	14	5		1					
13	27		5		3	4	5	9	1						
14	62		5		8	5	28	8		7		1			
15	38		4			3	17	6	1	6	1				
16	96		3		1	6	23	8	19				36		
17	37		1		1	6	19	6	1	1	1			1	
18	86		8		3	25	26	12		1				11	
19	58		4		5	5	30	7	4	2				1	
20	68		3		3	9	37	8	1	1	1	2		2	1
21	47		1		1	3	32	5		1	2			2	
22	30				4	1	13	7		1	3			1	
23	16				1		12	1		1				1	
24	13				4		4	1		2	2				
26	1										1				
28	21					1	9						11		
30	81			70			9							2	
32	2						1				1				
36	2			2											
Unknown	49	21	12		1	6	4								5
Total	1,153	27	233	72	105	101	371	99	27	24	12	3	47	26	6

TABLE 26A.—FLAT MACHINES OF DIFFERENT WIDTHS, CLASSIFIED ACCORDING TO RATING

Width in inches	Total	Rating (per cent)									
		0	5	10	15	20	25	30	35	40	Unknown
2 to 5	3				2	1					
9	2		2								
10	19		3		14	2					
11	1		1								
12	20		14		6						
14	6		3		1	2					
16	23		19	1	3						
18	32		26	1	1	4					
20	38		22		4	10		2			
21	1		1								
22	20		16		2	2					
23	1				1						
24	27		8	1	10	7	1				
25	2		2								
26	18		15		1	2					
27	1		1								
28	9		7		2						
30	4		2			2					
31	2		2								
32	43		41		2						
33	1		1								
34	6		6								
36	12		9		1	2					
37½	6				1					5	
40	7		4								
44	5		1								
45	4		4								
48	3					1			2		
52	1					1					
80	3		3								
100	10		10								
Unknown	121	59	40	1		1					20
Total	451	59	263	4	51	44	1	2	2	5	20

DETAILED TABLES—Continued

TABLE 27.—CIRCULAR MACHINES WITH DIFFERENT NUMBERS OF NEEDLES PER INCH, CLASSIFIED ACCORDING TO RATING

Needles per inch	Rating (per cent)														
	Total	0	5	7½	10	15	20	25	30	35	40	50	65	75	Unknown
2.5 to 2.9	63	1	60		2										
3 to 3.7	26		23			3									
5.1 to 5.7	20		5		8		2	2					3		
6 to 6.9	30		1		10	6	7	1		5					
7 to 7.8	198	1	27	2	21	25	38	45	8	5		1	25		
7 or 8	70				14		48						8		
8 to 8.5	252		15		24	49	139	14		11					
9 to 9.3	43		9			4	7	6	4		12		1		
10 to 10.7	113		9	8	5	3	53	15						20	
11 to 11.5	9		2				4					2	1		
12	90	2	18	3	8	4	34	14		3				4	
13 to 15	24		4	1	12		4	1						2	
16 to 18	37			36				1							
Unknown	178	23	60	22	1	7	35		15				9		6
Total	1,153	27	233	72	105	101	371	99	27	24	12	3	47	26	6

TABLE 27A.—FLAT MACHINES WITH DIFFERENT NUMBERS OF NEEDLES PER INCH, CLASSIFIED ACCORDING TO RATING

Number of needles per inch	Total	Rating (per cent)									
		0	5	10	15	20	25	30	35	40	Unknown
2½	134		133			1					
3	31		30			1					
4½	2		2								
5	15		10	1		4					
6	9		4	1	1	3					
6 or 8	13				13						
6½	1					1					
7	52		11	1	32	6			2		
8	29		14		4	11					
10	23		11		1	4		2		5	
12	14		9	1		4					
14	1						1				
18	9					9					
Unknown	118	59	39								20
Total	451	59	263	4	51	44	1	2	2	5	20

TABLE 28.—CIRCULAR MACHINES WITH DIFFERENT RATINGS, CLASSIFIED ACCORDING TO NUMBER OF FEEDS

Rating (per cent)	Total	Number of feeds														
		1	1 or 2	2	3	4	4 or 6	6	4 or 8	6 or 8	8	8 or 12	10	12	20	Unknown
0	27	2		2												23
5	233	44	14	121		15		2			1					36
7½	72							72								
10	105	3		67		8		12	14							1
15	101	3		16		16	4	41		4	10					7
20	371	12	10	67	1	7		65		20	132	40	1	5		11
25	99	4		20		31					41			3		
30	27			23		4										
35	24			16							8					
40	12										12					
50	3					1					2					
65	47					37		10								
75	26			3	2	10						9			2	
Unknown	6															6
Total	1,153	68	24	335	3	129	4	202	14	24	206	49	1	8	2	84

DETAILED TABLES—Continued

TABLE 28A.—FLAT MACHINES WITH DIFFERENT RATINGS, CLASSIFIED ACCORDING TO NUMBER OF. YARN CHANGES

Rating (per cent)	Total	Number of yarn changes						
		0	1	2	3	4	5	Unknown
0	59							59
5	263	75	27	43	22	10	3	83
10	4	2			1			1
15	51	23		9	16	1		2
20	44	10	3	6	10	14		1
25	1				1			
30	2	2						
35	2				2			
40	5						5	
Unknown	20							20
Total	451	112	30	58	52	25	8	166

CENSUS CARD

The card used in gathering data for this survey of Philadelphia knitting machines is reprinted below.

MACHINE STUDY CENSUS CARD

Name and address of mill.. Date..............

Name and address of machine manufacturer................................ Code No............

Type of machine. 1. {Hand.................. / Power..................} 2. {Flat.................. / Circular.............. / Raschel...............} Serial No. of machine............

FLAT

1. Width..........................
2. No. needles per inch............
3. No. stripers....................
4. No. yarn changes................
5. Average speed per min...........
6. Plain or jacquard...............
7. Semi or full automatic..........

....

CIRCULAR

1. Diameter........................
2. Ribbed or jersey................
3. No. needles per inch............
4. No. feeds.......................
5. No. striper changes.............
6. Average speed, r. p. m..........
7. Plain or jacquard...............
8. Latch or spring needle..........

RASCHEL

1. Width of machine................
2. No. needles per inch............
3. Plain or jacquard...............

Per cent of time operated in past 6 months....................

Year purchased....................

New or secondhand.................

Has rebuilding or adding attachments varied or increased types of product?..................

Maximum and minimum sizes yarn used..

Types raw material used...

Has machine ever been rebuilt?..

Types of product made on this machine......................................

○

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